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AND ABSTRACT OF THE LITERATURE

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HONORARY CONSULTING EDITOR
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Cadmium Poisoning

Industrial Lighting Codes

Chronic Poisoning from Cyanogen Chloride

Welfare in Factories and Workshops

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THE JOURNAL OF INDUSTRIAL HYGIENE

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INDUSTRIAL POISONING IN THE MANUFACTURE OF AEROPLANES, EXPLOSIVES AND DYES*

THOMAS M. LEGGE, M.D., D.P.H.

His Majesty's Medical Inspector of Factories

I WISH to deal this evening with the way in which industrial poisoning attacks a worker, especially in those branches of industry which have come into such prominence during the war, namely, the manufacture of aeroplanes, explosives, dyes, and the process of dyeing. The first question one has to ask oneself in this connection is, "What is an industrial poison?" We can all define what we think a poison is — something which, when applied, acts chemically and effects transient or permanent injury to the tissues, organs, or functions of the body. But this is not enough in defining industrial poisoning; the outstanding point about an industrial poison is that it often acts without the knowledge of the worker and against his wish. I define an industrial poison, therefore, as one that is employed, produced, or somehow occasioned in an industrial occupation, and is brought about inadvertently and consequently against the will of the person poisoned, and, I might add, in the absence of sufficient precautions.

In general, the way in which these industrial poisons act (and the industries of which I am going to speak are good instances as showing the particular effects), is first, superficially on the skin, by their irritant and corrosive action; secondly, by absorption into the blood, the constituents of which they alter; and thirdly, by absorption into the system, with remote specific effect through the blood upon definite organs or tissues, as, for example, on the liver, on the heart, and on the nerves. There are only three ways in which industrial poisons can be absorbed, namely, (1) as gases or fumes, (2) as liquids, and (3) as solid substances or dust; and there are only three channels through which the industrial poisons can enter the system, namely, (1) by the lungs, in breathing them in as vapor or dust, (2) by the digestive tract in swallowing, and (3) through the skin itself by actual contact.

Several other points naturally have to be borne in mind in regard to an industrial poison, such, for example, as how far it is soluble in water, and how far it is able to dissolve fat (this latter is of special moment in the manufacture of explosives and dyes); the amount absorbed; the susceptibility of different individuals; age and sex; and lastly, the time it takes to absorb the poi-

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son. The symptoms, when small quantities are absorbed, are usually of slow onset, while sudden absorption of large quantities brings about rapid onset of symptoms. The first type of poisoning is spoken of as chronic; the second, as acute.

The war has given us remarkable examples of industrial poisons absorbed through the lungs and through the skin. As regards the first, I cannot do better than describe briefly what happened at the commencement of the war in the manufacture of aeroplanes. No better example of poisoning by absorption of a vapor through the lungs, and of how it can be prevented, could be given. I shall refer to only one branch of the industry, namely, the covering of the wings which are made of linen fabric stretched over a light frame of wood, rendered impermeable and taut by a coating of dope and varnish. The basis of the dope consists of acetate of cellulose, but in order to apply this it must first be dissolved, after which it is applied with a brush. Shortly before the outbreak of war, certain organic compounds, chlorine compounds of ethane and ethylene, had been manufactured by an inexpensive process, and as they were non-inflammable they appeared to have a useful function as solvents of fat, resin and rubber. One of these, tetrachlorethane ($C_2H_2Cl_4$), which chemically is closely related to chloroform, was the compound which at the commencement of the war was employed as an ingredient of the dope, being present usually to the extent of about 12 per cent., the rest of the dope consisting of acetone, benzol and methylated spirits. The method of applying the dope is very much the same as in painting. Each doper carries the mixture in a can in his left hand, and with his right brushes it on to the wing, which is supported on trestles. Three or four coats of dope are put on, each coat having to dry before the next is applied. As the wing of an aeroplane is too wide for one person to stretch across it, two work simultaneously opposite each other. Each worker has to lean over the wing, and hence it is impossible to escape inhaling the fumes with which the atmosphere is charged.

The dope, however, is considerably heavier than the air, tetrachlorethane vapor itself being six times heavier, so that its fumes tend to fall to the ground. This is a very important fact to remember in explaining the manner in which the poisoning occurs. I will give an instance in point. Two months after the war began, a man died in an aeroplane factory with symptoms of jaundice, and when I went to the factory I found that nineteen men from all parts of the big shed were suffering from jaundice. The shed was a very large one, and had originally been a tramway depot. It was supposed to be very well ventilated by a plenum system — that is, by a fan which forced the air into the room through a system of air trunks with branch ducts opening about 2 feet from the floor level — but seeing that the vapor is heavy and collects on the floor, this system was the very worst that could have been adopted and served merely to stir up the vapor and distribute it to all parts of the shed. Although the smell of the dope was strongest, and the cases of illness most numerous among persons employed nearest to where doping was done, several slight cases occurred among those working in remote corners of the shed. Experiments with the different ingredients of the dope by Dr. Willcox, the Home Office expert on poisons, proved quite conclusively that tetrachlorethane was the substance which caused the ill effects. At that time, nearly all rooms in which doping was done, perhaps thirty in all, were using this dope, but in order to keep the fabric dry—a condition to which considerable importance is attached as the fabric, if moist, is apt to rot — the air was kept at a temperature of about 70°, and the ventilation was intentionally reduced to a

minimum. The conditions were, therefore, almost ideal for favoring poisoning by tetrachlorethane and, indeed, cases of jaundice, fatal and otherwise, occurred rapidly one after another in other factories.

Now, what was the remedy for this state of affairs ? One's first idea would be to give up the use of the poisonous substance, one's second, to introduce pure air and as constantly to remove it by fans, in order to reduce the amount of poisonous vapor present. Unfortunately, at that time it was impossible to give up the use of the material since no other substitute was known, and recourse was had, consequently, to the second remedy. The size of the wings made it impracticable to remove the vapor, as one would like to have done, by applying the exhaust ventilation locally at the point where the fumes arose. Hence reliance was placed by the Inspector of Dangerous Trades, Mr. W. Sidney Smith, on a low-velocity scavenge of the air contents of the dope room. In ventilating by this method fresh air at low velocity is drawn into the room by the suction of exhaust propeller fans, placed at the floor level because of the heavy nature of the fumes. Air inlets of ample size are placed on the other side of the room at a height of 8–10 feet, this air being warmed by passage through radiators or piping heated by steam or hot water. In considering the action of an open blade propeller fan, I always think of it as being like the thread of a screw. Each blade is placed at a certain angle to the axis and if all the blades were separated and joined up together they would make the thread of a screw. Each revolution of the fan transfers just as much air from the inside to the outside as is represented by the length of all the blades combined. The standard of ventilation for a dope room is thirty changes of air per hour, thus the whole of the air is changed every two minutes. You might think such rooms would be draughty, but there should be no perceptible draught if the apparatus is properly arranged. The secret of preventing draughts is to have the area of the fresh air inlets at least three times the area of the exhaust fans. At the beginning of the war there were, I said, about thirty dope rooms; at the end there were considerably over 400 and every one of them was ventilated very much on this principle of thirty changes of air per hour.

This is not quite the whole story in regard to doping. If there are poisonous substances which can be dispensed with in a factory, then naturally it is to everyone's benefit to get rid of them, and, seeing how impossible it was to remove the fumes at the point of origin, efforts were made to eliminate the use of tetrachlorethane. Fortunately by September, 1916, this was achieved. Before tetrachlorethane had been given up, at least seventy cases of jaundice with twelve deaths had occurred, but since that time there has been no death and jaundice has disappeared. The dopes now used, however, still contain benzene — usually in a proportion of about 19 per cent. — acetone substitutes, methylated spirit, and other ingredients, and the temperature of the room must be kept at 70° F. at least. In order, therefore, to make the conditions as healthy as possible — they cannot, I fear, be made exactly pleasant because of the alcoholic vapors constantly given off — the standard of ventilation adopted is still insisted upon and maintained. Other ameliorative measures are fifteen-minute breaks in the morning and afternoon spells, alternation of work, free medical supervision, and transference to other employment of those who show signs of fatigue or of the effect of the vapor.

A poison of another type, which acts by irritating and corroding the lining membrane of the lungs, is nitrous fumes. I have a dread of the insidious nature of these fumes because of the tragic reports which reach me of inquests on men who have

rashly repaired leaks in the nitric acid plant without protecting themselves by any form of effective respirator or helmet. Unfortunately, familiarity with the fumes breeds contempt in the workman. The full effect of inhaling nitrous fumes is not felt immediately. The worker, after having been gassed, is able to go on with his work for three or four hours, when he finds that his breath is becoming short and he has, perhaps, difficulty in getting home. Later on, he develops bronchitis or pneumonia. Longer exposure than two minutes in a building where there has been a sudden escape of fumes which envelop the workman will cause death from suffocation. If exposure lasts only from one-half to nearly two minutes, he may rapidly recover on being removed to the open air and soon feel as if the danger were over, but in these cases intense congestion of the lungs follows. Workers who daily experience small escapes of nitrous fumes have relaxed throats and slight chronic bronchitis. I should like to see in acid works and whereever there is risk of escape of nitrous fumes, greater precautions taken against the poisonous effect of the gas, and to make it part of the first aid teaching that no workman should undertake repairs when fumes are escaping without wearing a suitable helmet or appliance through which air can be supplied.

Mention of benzol introduces the subject of coal tar, in the distillation of which, as you know, it is one of the earliest products obtained, and this leads up to the coal tar dyes. Benzene, if breathed in large amount, will soon cause unconsciousness, and several accidents have been so caused by it, but always as the result of accident, breakage, leakage, or ignorance in entering a tank or still to clean it, without wearing an air helmet. As the preparation of benzol is nearly always carried on in an enclosed apparatus, there is usually little risk. When, however, small quantities are breathed daily for a long time, say for weeks or months, as has been done in the india rubber industry during the war, benzene has shown itself to be a powerful poison. Thus, in a certain factory where proofing of balloon fabric with rubber dissolved in benzene was carried on, symptoms resembling scurvy occurred in two of the men, with fatal results. These were the first recorded cases in Britain and they were due to the rapid evolution of benzol vapor in the air when the cloth saturated with solvent was dried in passing over the steam-heated tables. Other cases, however, are known to have occurred in America and on the continent, all showing the same symptoms. Benzene alters the constitution of the blood, so that the red and the white blood cells — especially the latter — are greatly reduced in number.

As with dope poisoning, so also in the case of benzene locally applied exhaust ventilation is impracticable, and, as a means of prevention, precisely the same method of ventilation by volume fans as used in dope rooms will have to be adopted in spreading rooms, where benzene is used as a solvent for rubber. Necessity being the mother of invention, a way out will probably be found in a new substitute, namely, xylol compound, which has been obtained in immense quantities since the outbreak of the war from mineral oil coming from Borneo.

Turning now to poisons which act directly by absorption through the skin, we find the best examples in the intermediate substances obtained from coal tar and used in the manufacture of explosives and dyes. I can best illustrate what I mean by two examples — anilin oil and trinitrotoluene. I remember very clearly an inquiry in Lancashire into the death of a workman in a dyeworks. It was a very hot day and the workman was taking the cork out of a cask of anilin oil when, probably because the heat of the sun had caused pressure inside

the cask — the work was being done in the open air — some of it splashed upon his face and clothes. He washed his face but did not change his clothes, and after working for an hour went home. He became unconscious and never recovered. It was noticed when he returned home that his lips were quite blue and that he staggered and appeared like a drunken man. In this instance the fact that the man did not change the clothes upon which the anilin had been spilt and did not rid his skin of it by a bath, led to his death from absorption through the skin, and it is in the same way in large measure that all illness from nitro derivatives of benzene and toluene is caused.

In pre-war time we knew very little of the effects of trinitrotoluene — so little was it used. The chief impression, however, was that it was much less poisonous than dinitrobenzene, with the injurious effects of which we had considerable experience in Huddersfield. As long ago as 1901, Dr. Prosser White, the medical officer at the Roburite Explosives Works near Wiganand, and Dr. J. Hay of Liverpool, experimenting on themselves by rubbing into their skins small quantities of an ointment containing dinitrobenzene, showed unmistakably that it was quickly absorbed through the skin; and later, Dr. Malden of Cambridge went down to Huddersfield and Bradford and examined at the factory the blood of the persons engaged in making dinitrobenzene and dinitrotoluene, and in using anilin oil in the processes of anilin-black dyeing. In the case of the manufacture of D.N.B., it was shown quite clearly how rapidly absorption of the poison took place, and Dr. Malden pointed out that five of the twenty-one cases studied had been employed for one week or less, while only four had been employed for more than a year, and all had suffered from some symptoms of poisoning. The great effect of the compound was noticed in the change it brought about in the blood. The red blood cells varied very much in size, and were altered greatly in shape; instead of being round they became pear shaped and irregular in outline, and their number was diminished. Further, when the ear, for example, was pricked, the blood was not red but chocolate brown. The change was due to an alteration in the blood coloring matter, which prevented it from carrying oxygen from the lungs to feed the tissues of the body as efficiently as pure blood would do. In this way the symptoms of headache, drowsiness, shortness of breath, and blueness of lips were brought about. Very occasionally jaundice would appear, and in one fatal case which I remember at Huddersfield, the liver was found after death to be much diminished in size.

With regard to T.N.T., experience in pre-war time, as I said before, seemed to show that it was much less poisonous than D.N.B. Dr. Prosser White, indeed, had said it was not poisonous in ordinary use — a statement which was quite true at the time he made it, when no one could anticipate an extraordinary use of the material. It came as a surprise, therefore, when the workers in the National Filling Factories began to suffer from frequent illness, which in nearly all serious cases assumed the form of jaundice. Ordinary jaundice is never fatal, a fact which proved this new jaundice to be quite different, as the mortality rate among those suffering from it was very high — about 30 per cent.

The arrangements for the comfort and well-being of the workers in regard to change rooms, overalls, washing accommodation and meal-room accommodation had been well considered and the general plan of the factories in matters of lighting, heating and cubic space was satisfactory, yet as the poisonous nature of T.N.T. had not been anticipated, the conditions were for a short time baffling, both as to the essential cause of the trouble and the best means of prevention. In the process of fill-

ing with the molten amatol mixture containing T.N.T., with the pure T.N.T. in powder, or with ammonal mixture in powder, the quantity of fume and dust given off made one naturally forget White and Hay's experiments on skin absorption and attribute too much of the poison to inhalation of the dust and fume. Efforts, it is true, were made to prevent absorption through the skin by the provision of gloves, and to prevent inhalation of the dust by wearing respirators. It is easy to suggest the wearing of gloves, and gloves were provided and worn by the million, but they never adequately protected the skin since the powder or moist T.N.T. penetrated and percolated through, converting the gloves inside more into a poultice of T.N.T. than anything else. It was found also that the wearing of respirators for any length of time was impracticable.

In the summer of 1916, Dr. Benjamin Moore, working with his assistants in a T.N.T. factory for the purpose of discovering the cause of the trouble, repeated with T.N.T. very much the same experiments which Prosser White had made with D.N.B. He rubbed into the palms of his hands an amatol pellet containing 20 per cent. of T.N.T. In two hours traces of T.N.T. in the urine were noticed. He kept up the rubbing of amatol into his hands intermittently for about six hours, and for a period of ten days thereafter the presence of T.N.T. was detected chemically in the urine. During this time, Dr. Moore suffered from illness. Here, then, was proof that contact with T.N.T. ought to be avoided as much as possible. In this way the right measures of prevention were proved to be cleanliness of work, cleanliness in every meaning of the word, prevention of dust and of contamination of any part of the skin by the substance. Then began a campaign to achieve this in the factories. In addition to constant medical supervision and general welfare as to change rooms, washing, bathing, and the like, efforts were made to get rid of hand manipulation as far as possible. Mechanical means for filling shells with powder were introduced, and the shells protected from splashing in the operation of filling with molten T.N.T.; the congealed amatol on the trucks on which the shells were conveyed away was systematically removed by steaming instead of by the dangerous method of chipping; floors and benches were vacuum cleaned or mopped instead of swept down, and, as important as anything else, exhaust ventilation was locally applied wherever possible, in order to remove fumes and dust.

Effects of T.N.T. showed themselves in various ways. First — as is common with coal tar derivatives — there was a local effect on the skin, setting up inflammation which, however, quickly yielded to treatment; secondly, there was what appeared to be the same effect internally when the dust was swallowed — an irritative effect on the stomach causing gastritis and vomiting; thirdly, there was the effect produced on the blood, similar to but not nearly so characteristic or marked as that of D.N.B.; fourthly, as was not characteristic of D.N.B., there was a specific destructive effect on the liver cells, causing atrophy of the liver and jaundice; and lastly, a very rare form of anemia, always fatal, and due to the action of T.N.T. on the red marrow of the bones.

On January 1, 1916, it became the duty of every medical man treating a case of toxic jaundice contracted in a factory or workshop, to notify it to the Chief Inspector, and in this way we have since then been able to watch from month to month the progress of the measures taken to reduce the poisoning. The following figures, arranged in quarterly periods for 1916, 1917, and 1918 show how great was the increase of toxic jaundice at the end of 1916 and the beginning of 1917, and how, when we knew the cause and were able to take

effective measures, the improvements carried out in the factories eliminated much of the illness from T.N.T.

	1916				1917				1918			
	6^{4}	16^{5}	73^{21}	86^{22}	83^{12}	56^{20}	21^{8}	29^{4}	13^{4}	6^{2}	5^{2}	10^{2}
Total			181^{52}				189^{44}				34^{10}	

The small figures indicate fatal cases, and are included in the larger figures.

Finally, although the finished anilin dyes themselves may not be poisonous, several of them, such as chrysoidine, malachite green, and others, may act as violent chemical irritants to the skin, or rather to that part of the skin immediately under the cuticle where the blood vessels are spread out in a wide network of capillary vessels. One of these anilin dyes — aurantia or Emperor's yellow — which at one time was used for coloring cheap shoes, caused so violent an eczema that its use industrially was quite given up. The last time it was used to my knowledge was by the Germans as an ingredient of their bombs in a daylight attack on London. You remember after the raid a number of persons noticed a reddish-brown powder surrounding spots where bombs had fallen and did not explode. Many of those who touched or swept up this dust were attacked ten days later by a very severe inflammation of the hands. These dye substances penetrate to the blood vessels immediately under the skin and there they set up a reaction, with slowing of the blood current, dilatation of the blood vessels, the passage through them of plasma and white blood cells, and all the symptoms of inflammation — redness, swelling and pain.

Industrial eczema is very common, especially in the dye industries, if the substances setting it up are continually used. The substances causing eczema are: first, those which dissolve and remove the natural grease from the skin, such as turpentine, petroleum, benzene and its homologues and their nitro and amido derivatives; second, substances or processes which soften and macerate the skin, such as alkalites (soap and soda), or even continuous contact with water; and third, substances or processes which chemically or mechanically injure the continuity of the cuticle, such as brushing, scratching and rubbing, for the natural protection of the skin is its toughness and elasticity. The close union of the horny cells in the uppermost layers forms a sort of armor plating, and, when unbroken, prevents the entrance of germs (which are always present on the surface of the skin) and irritants. Further, the glands in the skin, which are of two kinds — the one the sweat glands, and the other the sebaceous glands attached to the hair follicles — constantly exude a useful oil and waxy, waterproofing material. The most important thing, therefore, in the way of protecting his health that the worker in the dye industry can do is to look well after his skin, and see to it that by frequent washing and bathing it is maintained in a healthy state. When the skin becomes dry and cracked by the substances used dissolving out the skin grease, the most important thing in treatment is to try and restore as far as possible the natural lubricant to the skin. This can be done, first, by careful washing after work so as to remove all the soap, and by thorough drying — unless drying is thorough, the skin becomes dry or chapped — and by smearing on a little of an ointment like lanoline and castor oil in equal parts, in just sufficient quantities to make the skin feel moist.

If irritating powders are being handled, it has been found much the best thing to protect the skin by dusting it with a dry powder like zinc oxide or starch, rather than by smearing on vaseline or ointment, since the noxious powders only cling to and collect on the ointment. This has been the experience during the war with the extremely irritating tetryl powder used as the detonator in fuses.

Not infrequently eczema spreads from the hands to other parts of the body with resulting pimples and boils. This is not the effect of the chemicals used, but indicates that germs on the skin have infected the original exudation, finding there a suitable nutrient medium. One of the great objects of early treatment, therefore, is to prevent these secondary infections which are much more intractable than the original eczema. Although it is true that the skin has a wonderful power of accustoming itself to the irritants to which it is exposed, by becoming thicker in places, it is hardly safe to rely on this, nor is it wise to explain freedom from eczema by saying that one workman is more susceptible than another. There is certainly often greater capability in one worker than in another to withstand the effect of irritating substances on the skin, but before accepting this view one ought to exclude certain factors in the work or in the way of doing it, such as carelessness, increased exposure, longer hours, or exposure to a higher concentration of the injurious ingredients. Some people, however, are so susceptible that they cannot go near an open bottle of one or another chemical without suffering. In such cases the only thing to do is to recommend the workman to seek other employment. This perhaps is more frequently done in the case of chrome dyeing than in any other process. Protection against chrome ulceration has, however, in my opinion, not been sufficiently tried. Chrome in solution in the dyeing trade, being a strong oxidizing agent, when it comes into contact with a broken surface in the skin will cause a hole or ulcer, and so long as the broken skin is uncovered every contact with chrome will tend to make the ulcer worse. If the fingers and hands, however, are regularly inspected and if abrasions are thoroughly washed and then covered with a waterproof plaster, no chrome will get in, and work may be continued. Instead of a chrome hole, in some very sensitive skins, eczema breaks out. In such a case as this the solution has penetrated the apertures in the skin for the small hairs. These hair follicles are portholes and catchment points so that it is all the more necessary to try and keep the skin covered with a fatty layer.

An eczema is much more likely to be widespread when the hands are soaked in solution or exposed to steam. On the other hand, where oil is the vehicle, one can see quite plainly how the oil chokes up these portholes and so leads to inflammation, and to pimples and boils. Only by thorough cleanliness, washing with warm water and soap, can the plugs be prevented from accumulating in the hair follicles, and acting as a focus of irritation and infection.

CADMIUM POISONING*

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THESE notes refer especially to one case, but the findings of the case crystallise what had previously been thoughts held in solution. I have unusual opportunities for comparing illness, usually attributed to lead poisoning, occurring among men employed in smelting lead and among men employed in smelting zinc, and have long recognised that the type of ill health differs in the two cases.

A man, aged 67, who had worked for many years at spelter works died in January, 1920, after having been paid compensation during ten years for what was allowed to be "plumbism," the chief symptoms being weakness, wasting and a tendency to bronchitis. At the *postmortem* examination the kidneys showed marked evidence of chronic interstitial nephritis and the heart was hypertrophied. Some of the liver was reserved for analysis by Mr. Seyler, the borough analyst of Swansea, who reported as follows: "The liver contained no lead and only a trace of copper. It also contained cadmium, 0.91 grains per pound, and zinc, 0.77 grains per pound."

The question naturally arises whether this really was a case of plumbism in which the lead, after having done some damage, had passed out of the system altogether, leaving behind, however, quantities of cadmium and zinc. Experiments dealing with the removal of lead from the system are very vague; none exist to show that lead is eliminated more quickly than cadmium or zinc; and until such experiments are forthcoming we can take it that the rate of excretion is probably the same for all three. On this assumption, the inference follows that if the case was one of metal poisoning, it was not one of lead poisoning; but that the active agent was cadmium or zinc or both.

During the last six years I have had eight cases of a similar nature where the analysis showed cadmium in quantities varying from 0.094 to 0.91 grains per pound, and zinc from 0.03 to 0.77 grains per pound; whilst the amount of lead has been, if any, merely a trace. The comparison between these cases from spelter (i. e., zinc smelting) works and others from lead smelting works is striking; in the analysis of livers of men who had worked in lead smelting, no other metal than lead was found.

Zinc Smelting

Spelter, the trade name for zinc, is obtained by mixing (a) calamine, (b) calcined blende (i. e., zinc sulphide from which the sulphur has been driven off by heat in the form of sulphur dioxide), and (c) carbon, in the form of very finely divided anthracite coal, and distilling the mixture in a series of baked clay retorts which are heated by producer gas, consisting of carbon monoxide and carbon dioxide. The red-hot retorts are filled by men under trying conditions; when the wind is blowing from a bad direction, smoke and fumes are blown down on the men; when the weather is very warm, they get heated and sweat profusely. Unfortunately the men are very careless as to the way they eat, drink and smoke, giving but little heed to the necessity for cleanliness, and getting but little encouragement in this direction. The retorts, which, though smaller than gas retorts, are set in a somewhat similar way, are arranged in rows. The top row of about twenty-five re-

* Received for publication March 23, 1920.

torts is charged first of all, and then a lower row; but whilst the lower retorts are being charged fumes are commencing to come off from the upper ones. These fumes, in spite of ventilating arrangements, come into close contact with the men.

Calamine, which consists of 35 to 45 per cent. of zinc, contains cadmium to the extent of 0.5 to 1.5 per cent.; and, as it is more volatile than zinc, the first lot of fumes contain cadmium. When all the retorts are charged their mouths are covered by "pipes" into which the zinc distils. These pipes are later covered over by nozzles in which the more volatile zinc is collected as zinc dust or oxide (together with some cadmium oxide) so that there is then less chance for the zinc to get into the men's faces.

Previous Observations

The fact that cadmium, which rarely exceeds more than 1 per cent. in the ore, is found in greater quantity than zinc in the livers of spelter workers is a very striking fact and one that deserves consideration. Hayhurst (1) points out that practically all recent authorities are agreed that zinc *per se* is non-poisonous. Sir Thomas Oliver (2) states that he could not find any evidence of ill health due to zinc itself, but adds that respiratory affections were common among zinc workers owing to chilling of the body when in a state of perspiration, and that rheumatic affections were complained of. According to Professor Thompson of Cornell University zinc fumes disorder digestion and irritate the stomach, causing gastralgia, nausea, and vomiting.

Neither of these authors refers to the effects of cadmium, but Dr. Legge has kindly drawn my attention to Erben's (3) observation that: "Soluble salts of cadmium resemble those of zinc (cadmium is more easily absorbed than zinc) but they are at all events more poisonous. Cadmium salts cause ulcerative gastro-enteritis and as they are excreted through the intestines and kidneys chronic poisoning sets up gastro-enteritis, nephritis and degeneration of the organs, while gastro-enteritis, convulsions, coma, slowing of the respiration and pulse, result from acute poisoning. Cadmium sulphide used as a paint is non-poisonous as it is insoluble. As the metal, it is used to make solders of low melting point." Kobert (4) says that: "Cadmium resembles zinc physiologically, toxicologically, and chemically. Lethal doses in guinea pigs, 0.15 to 0.30 grammes per kilo body weight. In man, recorded that 0.039 grammes of cadmium sulphate caused vomiting, salivation and tenesmus. Animal experiments — inflammation of bowel and nephritis. Cadmium sulphate twice as poisonous as zinc sulphate."

Athanasiu and Langlois (5) carried out sub-acute and chronic poisoning on animals. "Death resulted from inanition and gastric disturbance. Postmortem: gastro-enteritis, nephritis and a very chronic fatty degeneration of heart and liver."

Kunkel (6) says that cadmium is present to the extent of 5 per cent. in Silesan calamine. As it is more volatile than zinc it comes off first in the zinc distillation process. Of the compounds, cadmium oxide, as well as the soluble salts, is pronounced as poisonous. "The fullest experiments on the subject (Marme: Zeitschr. f. rat. Med., 1867, Vol. III, No. 29, page 125) show that soluble cadmium salts have a local effect — from burning sensation in the mouth to vomiting and diarrhea. Further, there are more remote effects, such as vertigo, feeling of weakness, slowing of the pulse and respiration, loss of power, unconsciousness, convulsions. In animals the symptoms of chronic poisoning consist in disturbed digestion and advancing emaciation. Anatomically have been shown gastro-enteritis, hemorrhages under the pleura, infarcts in the lung, fatty liver and heart muscles, diffuse inflammation of the kidney. Cad-

mium is, therefore, a much stronger poison than zinc."

Personal Observations

During the entire period, extending over several years, that I have been connected with lead and spelter works I have been impressed with the fact that the symptoms — all said to be due to plumbism — differed according to the works at which the patients had been employed.

Lead colic is a symptom once seen never forgotten; the agonising paroxysms are characteristic; the patients roll about the bed or floor groaning or screaming. But I have only seen it in men from the lead works. The gastric symptoms of men who have worked at spelter works consist of marked pain or tenderness at the epigastrium, associated with nausea and some constipation. The patient is dull and heavy, with loss of appetite, thirst, an unpleasant taste in the mouth and a thickly furred tongue. In some cases there is *diarrhea*. On reference to the above quoted authorities, the symptoms would appear to be similar to the irritating effects produced by cadmium. Workers in dusty zinc oxide factories do not exhibit such symptoms; but cadmium is absent from the zinc used for this purpose. Further, these symptoms are not (I am informed by Professor E. L. Collis) exhibited by men employed in redistilling zinc from the remainders or ashes of galvanising pots, although the retorts and furnaces used are exactly the same as those used in zinc smelting; but, as the temperature at which galvanising pots are worked would be sufficient to drive off any trace of cadmium from the zinc, these remainders must be practically free from cadmium. Cadmium, on the other hand, is readily given off from zinc-smelting retorts during the period before the nozzles are fixed; it is said to be more readily absorbed and to be physiologically more powerful than zinc; and the natural conclusion is that cadmium is responsible for the gastric disturbances among spelter workmen.

This gastritis caused by cadmium probably gives rise to an increased and more active area of absorption whereby any lead that is present in the blende has a chance of getting into the system. That gastritis prepares the way for lead absorption is borne out by the following facts. Previous to the time when I insisted on men who were starting at the lead works putting their mouths in order by having all their foul and rotten teeth extracted, it was very usual for fresh workers from the country to be laid up with colic in the first few weeks; now we never find such an occurrence, for by the removal of the oral sepsis, the stomach is able to digest the more luxurious dietary, especially in the form of meat, in which, due to their much higher wages, the men are prone to over-indulge. Alcohol no doubt plays a part in predisposing men to plumbism, but as this factor has not been eliminated one must credit the introduction of the above mentioned dental precaution with the good results.

The rheumatic affections referred to by Oliver as being prevalent in spelter workers may, I think, be ascribed to auto-intoxication from deranged stomachs which sometimes give evidence of acute gastritis, but more often are chronically and progressively disturbed.

Conclusions

1. Cadmium belongs to a group of heavy metals some of which are recognised to possess toxic properties.

2. Cadmium has been found experimentally and industrially to possess toxic properties.

3. Men employed at zinc smelting are exposed to the absorption of cadmium in the form of fumes.

4. After death cadmium is found in ap-

preciable amounts in the organs of the body.

5. These men experience symptoms atypical of lead poisoning as seen among lead smelters, but similar to those attributed by other writers to cadmium.

BIBLIOGRAPHY

1. Hayhurst, E. R.: Diseases of Occupation and Vocational Hygiene, edited by G. M. Kober and W. C. Hanson. Philadelphia, P. Blakiston's Sons & Co., 1916; London, W. Heinemann, Ltd., 1918, p. 18.
2. Oliver, T.: Diseases of Occupation. London, Methuen & Co., 1908; New York, E. P. Dutton and Company, 1916, p. 222.
3. Erben: Vertgiftungen, 1909, Vol. 1, p. 432.
4. Kobert: Lehrbuch der Intoxicationen, Vol. 2, p. 399.
5. Athanasiu, J., and Langlois, P.: Recherches sur l'Action Comparée des Sels de Cadmium et de Zinc. Arch. de physiol., 1896, **28**, 251.
6. Kunkel: Handbuch der Toxikologie, 1899, p. 175.

INDUSTRIAL LIGHTING CODES*

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THE protection of workmen from eye strain due to the conditions of their occupation has of late years been recognized as a matter of serious importance. Traumatic injury from occupational causes has been long a matter of concern, but eye strain as such is no less harmful to industrial usefulness, and should have at least equal consideration. It arises chiefly from two causes — insufficient light for easy seeing, and misdirected light, producing glare. In either case the eye attempts to protect itself by muscular effort and the result is the condition of eye strain, producing directly painful and unpleasant symptoms, and, indirectly, nervous affections such as generally accompany prolonged effort to accommodate the organism to uncomfortable conditions. If everyone possessed quite normal vision and could stay young the situation would be easier, but as a matter of fact only a small proportion of the population can fairly be called emmetropic and the inevitable loss of accommodation with increasing years not only aggravates existing errors of refraction, but may bring added strain from vain attempts at the near vision sometimes required by the occupation.

Dr. George M. Gould in a recent paper has estimated that, taking the population as a whole, approximately between 40 and 50 per cent. are victims of ocular or eye-strain diseases, using disease in its broader signification. Dividing the population into groups, the proportion thus afflicted begins with the group having outdoor occupations in which less than one person in five is affected, and ends with the group engaged in work requiring the minutest application, such as die cutting, proof reading and diamond polishing, in which more than four out of five suffer from eye conditions. The importance of occupational affections of the eye is, therefore, very strongly emphasized and has indeed been widely recognized — perhaps never better than in a recent report of the Massachusetts State Board of Health, in which the following statement occurs:

> It is a well-established fact that either the overuse of the eyes or the use of eyes under bad conditions may give rise to eye-fatigue or to eye strain; and many eye specialists believe that at least 80 to 90 per cent. of headaches are dependent upon eye strain. It is impossible to ignore the probability that many individuals working by gaslight, or even by electric light, in dirty, unpainted, overheated rooms, with impure air and excessive moisture, for ten hours a day or merely for the last two hours during the day, use up a great deal of nervous energy, and suffer from eye-fatigue, or eye strain, and its consequences.

Aside from this, there is a strong probability that bad lighting, especially in passageways, halls, and stairways, is responsible for a material increase in accidents. The mere fact that, according to the statistics given the writer by an accident insurance expert, 18 per cent. of industrial accidents occur in these places, points directly to the need of ample lighting. The Chief of the Bureau of Electric and Mechanical Equipment of the Department of Labor in the state of New Jersey informs the writer that one matter forcibly brought to the attention of the department was the large number of tripping accidents in work spaces, aisles, passageways and exits, investigation of which showed clearly that

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in many cases objects had been left in these spaces where, due to poor lighting, they had not been noticed by the injured person. In some cases it was found that sharp contrast of light and shadows caused the accident, in others an insufficient light intensity. By reason of these various conditions the states of New York, New Jersey, Pennsylvania, California, Oregon and Ohio have adopted industrial lighting codes requiring certain minimum amounts of light to be furnished for industrial operations and for passageways and exits, together with suitable precautions against the effects of glare. These codes have been in the main based on a tentative code drawn up by the Committee of the Illuminating Engineering Society, afterwards adopted by the Committee on Labor of the Council of National Defense, and widely promulgated as a suitable standard. (See page 136.)

The several codes differ somewhat in detail, but have in general the following provisions. First, a minimum intensity of illumination is required for industrial operations, ranging from about 1 foot-candle for the coarsest manufacturing work to 5 foot-candles for the finest—intensities which are obligatory. Second, a specified minimum illumination is required for passageways, exits and stairways, with special reference to preventing the class of accidents which occur in these places. Third, all the codes contain provisions against glare, more particularly that which arises from having bright, unscreened sources of light within the field of view of the workers. This is an old and well-known source of ocular trouble which not only is liable to create serious eye strain but also badly hampers the operations under way by interfering with easy vision. The provisions directed toward this end of eliminating glare, including violent contrasts of light and shade, vary somewhat in detail but are generally of fairly effective character. They particularly aim toward keeping unscreened sources of light high enough to be out of the ordinary field of view, and toward adequate screening by suitable shades of those light sources which, from the conditions of illumination, cannot be so placed. Finally, in order to prevent accidents associated with panic resulting from the extinguishment of the regular lighting system, the codes generally contain provisions for at least a certain amount of independence in the lighting for passageways, stairways and exits, so that the failure of the work room lighting will be unlikely to involve proper lighting of the way out.

These codes, it should be understood, are intended directly to promote the safety and comfort of the workman and are concerned in no way with the better illumination which, as a matter of experience, has been found to promote industrial efficiency. This latter is a matter for the employer and the workman, but is without the scope, as yet, of mandatory regulation. The need of such codes is very quickly impressed on anyone who has occasion to visit industrial establishments. Many such establishments are, in fact, found to be very badly illuminated, so that after dark the workers are plainly struggling to see — a fact which any ophthalmologist would quickly recognize from the attitudes and expressions characteristic of eye strain. Often these bad conditions may be found in small shops where comparatively close work is going on, and not infrequently in larger works which have been in operation for many years — works in which perhaps machinery has been improved to promote more efficient manufacturing, but in which the same old, inefficient and injurious lighting system installed years ago is retained. Bare incandescent lamps so placed as to shine directly into the eyes of the workman are probably the commonest source of trouble. The old carbon incandescent lamp was bad

enough when so misused. As it has been replaced by the metallic filament lamps and still later by lamps having gas-filled bulbs, these conditions have gone from bad to worse until they are now, in many instances, quite intolerable. Add to this, illumination on the work insufficient in amount, and one has a combination which is a matter for serious anxiety. With suitable shades not only would the dangerous glare be eliminated, but more light would be directed on the work — light which is now utterly wasted.

The relief of eye strain is equally desirable for the employer and for the employed. The employer feels the results of eye strain on the part of the worker in the less effective work performed and in the increased absenteeism from the concomitants of eye strain and a considerable chance for accidents. Increase in the intensity of the illumination, provided accompanying glare is eliminated, undoubtedly will do much toward lessening occupational troubles with the eye, since there is good reason to believe that with decrease of illumination below a high physiological standard there is an increase of eye strain in geometrical ratio. The physiological standard is roughly set by the capacity of the eye to attain its normal acuity and shade perception. This capacity has been pretty thoroughly investigated for a good many years past and serves as a basis for setting mandatory intensities for various industrial conditions. The finer the work — and especially if on material of dark color — and the closer the attention required in manufacture, the more illumination must necessarily be furnished for safe working.

Quite aside from this is another phase of the matter which has to do with the increase of industrial efficiency. In the last few years there have been many experiments on the extent to which an operation, capable of being carried on at a certain illumination, gains in facility when this illumination is increased. It has been found by experiment that quickness of vision demands much higher intensities than the mere recognition with certainty of the same detail. It is now not uncommon to find factories provided with illumination three or four times the minimum code requirements and with great gains in quantity and quality of production.

Broadly, therefore, the application of the lighting code is a step toward improving production — not a long step for it is gauged merely by the safety of the workman, but a step altogether in the right direction. Considerable opposition has been made to the introduction of industrial codes on the part of some rather short-sighted employers, usually based on contentment with conditions which have been endured in the past, on intense dislike of any legislative interference, and often on a somewhat unwarranted fear of costs. Inasmuch as at ordinary costs for electric service an additional illumination of 1 foot-candle costs for energy only from 60 to 80 cents per hour per acre of space illuminated, comment on this last phase of the matter seems hardly required. The codes are going ahead now somewhat rapidly, and various states, including Massachusetts, are now working on the problem with an earnest desire to improve the industrial situation. If all employers were as keen to better their conditions of production as some have already proved to be, legislative action would become unnecessary. As the human case stands, however, nothing but the enactment and enforcement of codes will bring about the much needed relief which the workers of the country deserve, and which they must have.

GENERAL LIGHTING SAFETY ORDERS *

Order 1501.

General Requirements

(a) Working or traversed spaces in buildings or grounds of places of employment shall be supplied, during the time of use, with either natural or artificial light in accordance with the following Orders (1502–1509).

Order 1502.

Natural Lighting

(a) Windows, skylights or other roof-lighting construction of buildings shall be arranged with the glass area so apportioned that at all the darkest part of any working space, when normal exterior daylight conditions obtain (sky brightness of 1.50 candlepower per square inch), there will be available a minimum intensity equal to twice that of Order 1503, otherwise artificial light of intensities specified in Order 1503 shall be provided.

(b) Awnings, shades, diffusive or refractive window glass shall be used for the purpose of improving daylight conditions or for the avoidance of eye strain wherever the location of the work is such that the worker must face large window areas through which excessively bright light may at times enter the building.

Note. — The intensity requirements for adequate day lighting are much higher than those for adequate night lighting, because in general under daylight conditions the light reaching the eye from all surroundings in the field of vision is much brighter than at night, and hence a correspondingly more intense light must fall on the object viewed.

* Code issued by the Industrial Accident Commission of the state of California, the latest in force at the time of writing, and typical of the codes based on the general recommendations of the Illuminating Engineering Society.

Order 1503.

Artificial Light

(a) When the natural light is less than twice the minimum permissible intensities of illumination set forth in the following table, artificial light shall be supplied and maintained in accordance with the table.

Note. — See Appendix for intensities recommended for best working conditions.

	Foot-candles at the floor level
1. Roadways and yard thoroughfares	0.02
2. Storage spaces, stairs, stairways, halls, hallways, passageways, aisles, exits and elevator entrances	0.25
3. Watercloset compartments, toilet rooms, washrooms, dressing rooms and elevator cars	0.50
	Foot-candles at the work
4. Work not requiring discrimination of detail, such as handling material of a coarse nature, and performing operations not requiring close visual application	0.50
5. Rough manufacturing requiring discrimination of detail, such as rough machining, rough assembling, rough bench work, also work in basements of mercantile establishments requiring discrimination of detail	1.00
6. Rough manufacturing requiring closer discrimination of detail, such as machining, assembly and bench work, also work in basements of mercantile establishments, requiring closer discrimination of detail, intermediate between 5 and 7	2.00
7. Fine manufacturing, such as fine lathe work, pattern and tool making, also office work, such as accounting and typewriting	3.00
8. Special cases of fine work, such as watchmaking, engraving and drafting	5.00
9. Processes otherwise safeguarded in which light is detrimental	0.00

Note. — Some exceptions to the intensity rule:

(a) There are some operations that are performed in comparative darkness, as for

example, photographic processes in the dark room.

(b) There are some operations that are best observed by their own light, as in parts of the process of working glass.

(c) Some operations are best observed by the "silhouette" method of lighting in which the work is seen against a lighted background in a comparatively dark room, as in some processes of working with dark threads and lamp filaments.

In all such cases in which work is of necessity carried on in comparative darkness, special precautions should be taken to properly safeguard the workmen.

Order 1504.

Measurements

(a) For the purpose of light measurements, a standardized photometer, certified by the Industrial Accident Commission of the state of California, shall be used, and such measurements shall be made at the locations specified in the table.

Order 1505.

Shading of Lamps for Overhead Lighting

(a) Lamps suspended at elevations above eye level less than one-quarter their distance from any positions at which work is performed, or where places are traversed, must be shaded in such a manner that the intensity of the brightest one-quarter square inch of visible light source shall not exceed 75 candlepower per square inch.

Exception. Lamps suspended at elevations greater than 20 feet above the floor are not subject to this requirement.

Note 1. — Glare from lamps or unduly bright surfaces produces eye strain and increases the accident hazard. The brightness limit specified in this Order is an absolute maximum. Very much lower brightness limits are necessary in many interiors illuminated by overhead lamps, if the illumination is to be satisfactory. In some cases the maximum brightness should not exceed that of the sky (2 to 3 candlepower per square inch).

Note 2. — Where the principal work is done on polished surfaces, such as polished metal, celluloid, varnished wood, etc., it is desirable to limit the brightness of the lamps in all downward directions to the amount specified in this Order.

Note 3. — For method of measuring brightness, see Appendix, paragraph 86.

Order 1506.

Shading of Lamps for Local Lighting

(a) Lamps for local lighting must be shaded in such a manner that the intensity of the brightest square inch presented to view from any position at which work is performed, shall not exceed 3 candlepower.

Note. — In the case of lamps used for local lighting, at or near eye level, the limits of permissible brightness are much lower than for lamps used for overhead lighting, because the eyes are more sensitive to strong light received from below, and because such light sources are more constantly in the field of view.

Order 1507.

Distribution of Light on Work

(a) The reflector or other accessories, mounting heights and spacings employed with lamps shall be such as to secure a reasonably uniform distribution of illumination, avoiding objectionable shadows and sharp contrasts of brightness. If local lighting is used, there shall be employed in addition a moderate intensity of overhead lighting, with a minimum of not less than one-fourth foot-candle.

Exception: Where the light from the local lamps falls principally upon surfaces

which are white or nearly so, and the ceilings and walls of the rooms are light, there is often a sufficient general illumination received indirectly by reflection to obviate the necessity of additional overhead lighting.

Note. — When local lighting is used as the sole source of illumination of an interior, the field of illumination from each lamp is in contrast to the surrounding darkness, thereby causing eye strain and increasing the accident hazard.

Order 1508.

Emergency Lighting

(a) Emergency lights shall be provided in all workspace aisles, stairways, passageways, exits, outside landings of fire escapes and other structures, used as regular or emergency means of egress. These emergency lights are to provide for adequate illumination when, through accident or other cause, the regular lighting is extinguished.

Note 1. — It is the intention of this Order to guard against accident due to the failure of the regular lighting system, by providing sufficient illumination to enable the occupants to:

(1) Avoid contact with moving machinery and other danger points until the regular lighting is again placed in operation.

(2) To vacate the building safely and expeditiously when this is necessary because of fire or other causes.

Note 2. — Emergency lighting may be installed in various ways. The method to be employed depends upon the size of the premises, the extent of the hazards of employment, and the means available for supplying such emergency lighting.

(b) Emergency lighting systems, including all supply and branch lines, their runways, raceways and supports, shall be entirely independent of the regular lighting system, and shall be lighted concurrently with the regular lighting system and remain lighted throughout the period of the day during which artificial light is required or used.

(c) Emergency lighting shall have a minimum intensity of one-fourth foot-candle. The emergency illumination shall not exceed 50 per cent. of the distributed illumination.

(d) Emergency lighting systems shall be supplied from a source independent of the regular lighting system in theaters, public meeting halls, moving picture exhibition places, hospitals, schools, and any other place where the nature of the hazard is such as to require it, except where an exemption is granted by the Industrial Accident Commission. This source of supply and controlling equipment shall be such as to insure the reliable operation of the emergency lighting system when, through accident or other cause, the regular lighting system is extinguished. Where a separate source of supply cannot be obtained for the emergency lighting, the feed for emergency lighting must be taken from a point on the street side of the service equipment. Where source of supply for the regular lighting system of sufficient capacity to supply all emergency lighting must be installed from some other source, a suitable storage battery, or separate generating unit may be considered the equivalent of such service.

Order 1509.

Switching and Control Apparatus

(a) Switches or other controlling apparatus shall be so installed that pilot or night lights may be controlled from a point at the main entrance, and from other easily accessible points. Pilot or night lights may be a part of the emergency lighting system.

(b) All switching and control apparatus on emergency, pilot and night lights shall be plainly labeled for identification.

Note. — The purpose of this Order is to make it possible for the night watchman or other qualified persons to turn on enough lamps, when entering any portion of the premises at night, to enable them to safely see their way around without the need of a lantern or flashlight.

CHRONIC POISONING FROM CYANOGEN CHLORIDE*

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IT is the purpose of this paper to present some clinical and experimental data on chronic cyanide poisoning, concerning which there has been some confusion of opinion. A survey of the literature on this subject brings to light many reports of poisoning by cyanides with recovery, in many of which cases there were no chronic symptoms. Cohen (1) and Wilkes (2) both report such cases.

On the other hand there are many reports, both clinical and experimental, of chronic effects. Souwers (3) and Boddaert (4) both report chronic effects, but only from repeated exposures. Collins and Martland (5) report a case of peripheral neuritis with eventual recovery, as a result of repeated exposure to a solution of hydrocyanic acid of unknown concentration. Schlegel (6) reports as an experimental result of repeated administration of sublethal doses of cyanide, chronic cachexia with increased susceptibility. Koritschöner (7) found, in an attempted treatment of tuberculous patients with hydrocyanic acid gas, that definite chronic symptoms resulted from which there was rapid recovery after cessation of the treatment.

Winternitz (8) claims that halogen cyanides produce pulmonary edema and congestion which is very persistent, but this is evidently due to the halogen radical as we will attempt to show later in this paper.

Quite recently Fühner (9) has made an experimental study of hydrocyanic acid poisoning in connection with its use as a germicide, in which he found symptoms of acute poisoning, consisting of salivation, metallic taste, lingual petechiae, reddening of the forehead, general weakness, lowered blood pressure, thoracic muscular pains, general malaise and vomiting. He is inclined to the view that repeated doses do not produce chronic poisoning but *may* increase susceptibility.

The author has already reported a series of experiments on repeated exposures to hydrocyanic acid from which it is apparent that chronic symptoms occur only on repeated exposure, a severe exposure that is not immediately fatal producing only fleeting effects, though long exposure to very low concentrations may produce mild chronic effects. Furthermore, there were no manifestations of increased susceptibility but some indication of a certain degree of tolerance (10).

Interest in this subject was aroused by the report of certain symptoms noted by men employed in a small plant engaged in the manufacture of cyanogen chloride. Although this did not come to our attention until after all of the men had been relieved of this work, so that no objective symptoms could be recorded, careful questioning of the men brought out a fairly definite clinical picture. These men were exposed daily under conditions which did not permit of persistence of a high concentration but there was continually a certain amount of escaping gas. Some of the men very rarely took any protective precautions, which indicates that the concentration cannot have been very high. Histories were obtained from fourteen men who were all in good physical condition at the beginning of their period of employment. A typical history is presented in brief, together with a statement of the more striking individual manifestations.

This typical subject was exposed every

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day for eight months, three times suffering severe exposures that caused dizziness, nausea, profuse lachrymation, blurring of vision, gasping, coughing, staggering, and prostration that lasted several hours. Chronic symptoms were muscular weakness, lassitude, congestion of the lungs, irritation of the skin, hoarseness, conjunctivitis, edema of the eyelids and burning urine. There were also periods of irregular pulse that bore no relation to heavy exposures. The appetite was decreased after severe exposures but at other times was abnormally increased. During this period his weight fell from 170 to 150 pounds but at the end of five weeks after change of occupation he weighed 160 pounds.

The principal variations from this picture among the other men were chronic vomiting, diarrhea, frequent urination, persistent coughing, spasmodic pain in the respiratory muscles, cold perspiration and chronic dull headache; certain of the men also complained of mental disturbances though these may have been due to the weakened physical condition. These symptoms were of varying severity in the different subjects. In addition to these, certain individual manifestations may be noteworthy. One subject lost 25 pounds in weight in a month and regained 5 pounds in ten days after transfer from the work. Another, weighing 116 pounds in the beginning, lost 14 pounds in five months and regained 6 pounds in five days off duty. One complained of lumbago and chromidrosis, another of a tendency to paralysis of the entire thoracic musculature of the left side along with other rather severe typical symptoms. He also suffered blistering of the face and genitals after more than usually severe exposures. Still another man, who had a quantity of the liquid thrown into his face by an explosion, was blinded for five days, during which time there was some paralysis of the respiratory muscles with a mild degree of opisthotonos. All of these men eventually recovered with change of occupation. There seemed to be no evidence of alteration in susceptibility. While these symptoms resemble closely those reported for other cases of chronic cyanide poisoning, there are, however, some distinctive features, such as the loss of weight, congestion of the lungs and cutaneous manifestations that indicate a possibility of an additional factor.

In connection with these findings, several series of experiments were carried out. First, a series of six dogs was injected with sublethal doses of a solution of cyanogen chloride in 0.9 per cent. NaCl and kept under observation ten to twelve days. These animals lost from 5 to 15 per cent. of body weight. With one exception, they showed listlessness, chronic diarrhea, chronic cachexia, depressed reflexes, conjunctivitis and rhinitis in varying degrees. There was also a tendency to cardiac irregularity. Autopsies showed no macroscopic lesions.

A second series of eight dogs received lethal injections of cyanogen chloride but were previously protected by subcutaneous injections of sodium thiosulphate as suggested by Hunt (11). These animals lost from 5 to 14 per cent. of body weight, showed less cardiac irregularity, greater general depression and greater depression of reflexes than those of the first series, and several showed varying degrees of pulmonary congestion at autopsy. In general, it may be said that the symptoms were much more severe.

A third series, consisting of five dogs and a goat, was exposed to sublethal concentrations of vaporized cyanogen chloride on successive days for a period of two weeks, the periods of exposure varying from thirty minutes to two hours. In a few instances, some of the animals showed convulsions and paralysis during exposure, but none died as a result. Additional symptoms during exposure were irritation and ex-

citement, nausea, vomiting, urination, defecation, lachrymation and salivation. Subsequent developments were muscular tremors, weakness, listlessness, chronic diarrhea, depression of reflexes, tendency to cardiac arrhythmia, conjunctivitis, rhinitis, progressive increase in pulse and respiratory rate. Two dogs were rather severely blistered in the inguinal region. In general, the symptoms were still more severe than in the second series, though less so for any given exposure. There was an average loss of 13 per cent. of body weight for the dogs and 17 per cent. for the goat. All of these animals showed a severe degree of pulmonary congestion at autopsy.

Another series, already reported (10), was now exposed under the same conditions to sublethal concentrations of vaporized hydrocyanic acid, with resulting less severe symptoms during exposure than for the corresponding experiments with cyanogen chloride. During the experimental period of ten days there was a loss varying from 2 to 11 per cent. body weight, most of which occurred from the third to the fifth days, with no particular change thereafter, while two animals gained slightly during the remainder of the period. These facts indicate that either there was developed a certain degree of tolerance, or else the early loss was due to some unrecognised factor. In all the other series any loss of weight was progressive.

Animals subjected to lethal administrations of the two substances die with much the same train of symptoms. These facts, together with the findings in the cases reported and the results of the experiments, indicate that, while the principal effects of poisoning by cyanogen chloride are much the same as those from hydrocyanic acid, there are certain points of difference: the loss of weight is greater from cyanogen chloride, the increase in heart rate is greater, there is conjestion of the lungs, depression is more pronounced and there are greater muscular disturbances. It has been suggested that this difference in action of the two compounds is dependent upon the presence of chlorine in the cyanogen chloride. In this connection may be mentioned another series of experiments previously conducted, in which goats were exposed to what had already been proven to be lethal concentrations of cyanogen chloride. These animals survived the usual danger period of a few hours for such exposure, but died in from one to three days with severe pulmonary congestion resembling that resulting from exposure to chlorine.

Summary and Conclusions

From the similarity of experimental results and clinical pictures of poisoning from cyanogen chloride and from the more common cyanides, it may be concluded that the chronic effects resulting from the former are due to chronic cyanide poisoning.

It is probable that certain symptoms noted as resulting from chronic poisoning with cyanogen chloride may be due to the presence of chlorine.

The chronic symptoms of cyanogen chloride poisoning are more severe than those resulting from the more common cyanides.

Severe symptoms resulting from a single large dose of common cyanides may not be followed by any chronic symptoms, while a single large dose of cyanogen chloride may result in death as a termination of chronic symptoms.

BIBLIOGRAPHY

1. Cohen, B.: Cited in editorial on Poisoning by Prussic Acid Fumes. Brit. Med. Jour., 1916, **2**, 464.
2. Wilkes, G.: Lancet, 1904, **2**, 1058.
3. Souwers: Phila. Med. Times, April 27, 1878.
4. Boddaert, A.: L'Empoisonnement chronique par l'acide cyanhydrique. Ann. Soc. de méd. leg. de Belg., 1897–1898, **9**, 238.
5. Collins, J., and Martland, H. S.: Disease of the Primary Motor Neurones Causing the Clinical Picture of Acute Anterior Poliomyelitis: The Result of Poisoning by Cyanide of Potassium. Jour. Nerv. and Ment. Dis., 1908, **35**, 417.
6. Schlegel: Inaugural Address, Berlin, 1891, cited by Sollman.
7. Koritschöner, M.: Ueber die Blausäure und ihre Wirkung auf die Tuberculose der Lungen. Wien. klin. Wchnschr., 1891, **4**, 48.
8. Winternitz, M. C.: Anatomical Changes in the Respiratory Tract Initiated by Irritating Gases. Mil. Surgeon, 1919, **44**, 476.
9. Führer, H.: Die Blausäurevergiftung und ihre Behandlung. Deutsch. med. Wchnschr., 1919, **45**, 847.
10. Reed, C. I.: Chronic Poisoning from Hydrocyanic Acid. Jour. Lab. and Clin. Med., May, 1920, **5**, 512.
11. Hunt, R.: Zur Kentniss der Toxikologie einiger Nitrile und deren Antidote. Arch. internat. de pharmacod., 1903–1904, **12**, 447.

WELFARE IN FACTORIES AND WORKSHOPS*

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Introduction

A DEFINITE and considerable advance towards national control of the means of welfare of factory workers has been achieved during the Great War, by legislation as well as administration based on ideas and demands of the workers and on broadening views of employers and the nation.

The advance in the factories is, in detail, not strikingly different from results achieved in individual factories in many instances before the war, of which for long years there have been interesting records, official and other. Indeed we have evidence stretching as far back as the origins of factory laws, of separate, scattered efforts towards constructive means of personal welfare in factory life.

The recent new endeavours to apply principles of psychology and physiology to regulation of the conditions of personal labour in manufacturing industry carry back our thoughts to the reminder of Robert Owen to his brother manufacturers in 1813; that, just as power-driven machinery (then a recent innovation) was improved by being carefully tended, kept clean and well supplied with oil, so the far more complex, living mechanism of the worker would be greatly benefited if carefully studied and well treated. Although far more than a motor, the human worker is yet, in his capacity of producer of mechanical energy, a highly delicate motor, needing very specialised handling in the way of chemical alimentation and rhythmical activity or motion (1).

The vital change that this war has wrought is in the sudden shaking together of isolated movements into the beginnings of a co-ordinated, associated effort, and in the bringing to birth of a wider, general perception of the value of sustained application of method, science, and above all imagination, to the socially constructive reforms called for in industrial life. Not only is it freshly seen that welfare, like health, is one whole, being a vital function of life itself, including the joys of work as well as of rest, and that service in industry is national service, but, for the first time perhaps, there is some vision of the size and radical character of the work to be done. The welfare of industrial and labouring workers is seen as no small portion — owing to the many millions of persons concerned — of the whole field of human welfare; as well as a matter of multifarious detail in improved conditions of daily life inside and about our factories.

Some confusions and even opposition have no doubt arisen through a somewhat indiscriminate application of the term "welfare" to two distinguishable though interrelated things, the state of welfare (well-being and welfaring) of the persons concerned on the one hand, of which each person has his own view, and the particular measures or means tentatively and experimentally (and of course with fallible human factors) adopted to bring about that state of welfare in a rapidly changing condition of industry. These confusions and difficulties can however be cleared away, as progress is made in understanding what

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really is afoot, and as experimental measures are more fully tested and sorted into their proper place in accordance with the desires and aspirations of the persons concerned.

The fundamental term or notion "welfare" cannot be strictly defined for in some degree its content changes with the content of life generally, and it is indeed as complex as personality. While freely admitting that varied ethical and psychological as well as physiological and economic elements are involved, and that in the words of an American economist: "Welfare comprehends and represents all things of reasonable and rightful desire" (2), the immediate legislative and administrative problem is to discover and apply in the existing (or attainable) "conditions and circumstances of employment or the nature of the processes carried on" in factory life, those arrangements and material surrounding conditions which will best conduce to the personal health, efficient working and welfare of each and all the workers. Suggestions have been made, by those dissatisfied with some of the recent voluntary measures for securing welfare in munition factories, that the word should be replaced in its technical use by some other, free from those associations. In view of the stable meaning of the term in the English language, from Chaucer onwards, that would seem to be a mistake. The word is bound to stay with us and its use in the Act of 1916 is in harmony with tradition, while its application in practical measures is surely safe in the hands of expert administrators open to continual public criticism, basing, as they certainly will do, their work on the considered recommendations of joint standing industrial councils representing employers and employed, as well as of the various scientific research committees recently appointed.

While recognising that all conditions — including hours and pauses for rest and due prevention of over-fatigue, safety and general sanitation, special regulation of dangerous trades and adequate remuneration, as well as the newer methods of securing personal hygiene and well-being — are part of the means of welfare for factory workers, it is with the last named class of measures, tried on a steadily widening scale during the war, that this chapter is particularly concerned. More especially it has to show the position brought about by the new requirements being made in Orders under the Police, Factories, etc. (Miscellaneous Provisions), Act of 1916, Section 7. These now take on a fresh significance through the natural termination of temporary, special war measures, administered in munition factories by the Welfare Department of the Ministry of Munitions, and by the Factory Department, through "Emergency Orders" in both munition and non-munition factories.

Development of Welfare

Before the war it could be truly said that "the whole framework of modern life is economic," and that "it began with machinery and steam and had been built up within a century" (3). Then, isolated measures of welfare flourished here and there in factories, as expression either of the goodwill of individual employers to their workers or of their perception that good conditions paid, in better results. Then, too, the Factory Acts, and action and advice of the factory inspectors, laid the foundations of general hygiene and safety on which personal welfare can be (and often was) voluntarily built up although often totally lacking — as may be seen yearly in past annual reports of the work of the department.

During the war, and to a rapidly increasing extent, the whole national framework passed from an economic to a non-economic footing. Emergency measures and requirements to safeguard health and welfare be-

came urgently necessary, not only to counterbalance the inevitable interference with some of the legislative and customary limitations that arose mainly during the economic nineteenth century, but also to husband and promote the vital forces of workers under a previously undreamed-of strain of intensified national production. The abnormal conditions of mobility of personnel as well as hours of labour, and intensified output, called for special temporary measures, as tens of thousands of workers — not only men and boys but also women and girls — had to be transported to centres very hastily prepared for them. Many of these temporary measures, and some of them outside the main stream of the work of the Factory Department, lost their significance almost at the signing of the armistice or survive only in a modified form for the demobilisation period. Those, however, that belong to the safeguarding of permanent features of factory production and that are built upon the substructure of the Factory Acts, remain. They rapidly sprang into life and activity through recognition of the fact that the safety and welfare of the commonwealth were absolutely dependent on the safety and welfare of the industrial worker as the mainstay of the fighting forces of the Crown. They no doubt owed their effectiveness and rapid development during the war to previous social and administrative progress. Their continuance, however, in Welfare Orders and other ways is not simply a legacy of the war; it is due rather to an apparent ripeness of time for a new humanising of the whole condition of production for the manual worker.

We have learnt during the war that the kind and main aims of production have their influence as well as hygienic considerations in securing means of welfare for the industrial worker, and to recognise that "wages alone cannot adequately award those who serve the State in time of need." The future of this welfare movement will depend as much on imaginative construction as on the still indispensable production of ample material wealth.

The first definite official steps towards securing welfare conditions for factory workers in the revolutionary conditions that arose out of the war, in both munition and non-munition industries, were the appointment of: (a) the *Women's Employment Committee* (jointly by the Home Office and Board of Trade); (b) the *Health of Munition Workers' Committee* (by the Minister of Munitions with the concurrence of the Home Secretary); (c) *The Central Control Board* (Liquor Traffic), with its powers to establish and maintain (by themselves or through agents), refreshment rooms for the sale or supply of refreshments, for, among others, "persons employed in any particular industry" — all in the summer of 1915.

The task of the first committee (a) was to consider the situation arising out of rapid substitution of women for men, and the measures to be taken not only for mobilising reserves of women labour but also in preparation for social problems certain to arise — especially in housing, transit, and local need for canteens, patrols, recreation, clubs, care of the sick, etc. From their enquiry and recommendations sprang, early in 1916, the appointment of the first *Local Advisory Committee* (numbering upwards of forty, chiefly in great munition centres) co-ordinated by the *Central Advisory Committee*, under the chairmanship of Mr. Cecil Harmsworth. These were appointed by the Ministry of Labour in conference with the Home Office, the problems being mainly of welfare outside the factory connected with mobilisation of women and girl labour. They did good work in stimulating and co-ordinating the various voluntary and local efforts, until other means and measures arose, in the Welfare Section, Ministry of Munitions, in

the Canteen Committee of Central Board of Control (Liquor Traffic) and in governmental billeting administration. Some of these local committees were later absorbed into the system of representative local advisory committees attached to employment exchanges nominated usually by associations of employers and workers. These were, in their turn, largely concerned with re-settlement of labour on demobilisation, military and civilian.

The task of (b) the *Health of Munition Workers' Committee* under the chairmanship of Sir George Newman was "to consider and advise on questions of industrial fatigue, hours of labour and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops." This was not in any way an administrative committee, but advisory, and it proceeded by investigation, in co-operation with the Ministry of Munitions and the Factory Department. It issued a series of invaluable memoranda and reports which have not only affected administration and public opinion in this country but have proved of international value. Their issue came to an end with the publication of a handbook on the *Health of the Munition Worker* in October, 1917, and a final report on *Industrial Health and Efficiency* in April, 1918. Before the end of 1918 a research board was set up jointly by the Department of Scientific and Industrial Research and the Medical Research Department (National Health Insurance), to consider and investigate the same class of questions throughout the field of industrial employment, known as the Industrial Fatigue Research Board.*

(c) *The Central Control Board* (Liquor Traffic), appointed in June, 1915, was the government authority set up by an Order in Council under the Defence of the Realm Consolidation Act 1914 for the purpose of increasing directly or indirectly the efficiency of labour in any specified areas. They had power given them not only as regards establishment and maintenance by themselves or through agents of refreshment rooms but also to acquire compulsorily any premises or interest therein, to provide or authorise provision of entertainment or recreation, arrange for postal and banking facilities, and to appoint their own inspectors with powers similar to those of inspectors under the Factory and Trade Board Acts. In co-operation with the Factory Department and the committees above described, as well as with the Welfare Department later set up by the Ministry of Munitions, these powers were, with immense gain to industrial workers (munitions and other), exercised by the Canteen Committee of the Central Control Board and carried further by the Food Section of the Ministry of Munitions. The canteen movement, with very important aid from Y. M. C. A., Y. W. C. A., Church Army and other voluntary organisations, has extended enormously during the war. . . . Whereas before the war there were barely 100 regular factory canteens (as distinguished from many more messrooms) there were probably well on to a thousand working or in process of building before the end of 1918 and no important munition factory was without a canteen.

Much more direct and continuous co-operation, in matters of internal welfare in munition factories, than in any of the above cases was effected between the Home Office and the Welfare Department of the Ministry of Munitions when the latter was set up at the beginning of 1916 by the Minister, Mr. Lloyd George. The pioneer work of Mr. Seebohm Rowntree, the first director of the Welfare Department, was avowedly based on exhaustive reports by the factory inspectors on every large munition factory,

* Terms of reference: "To consider and investigate the relations of the hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers."

which showed the size and needs of the factories, particularly as regards women and girls, the basis as regards conditions under the Factory Act on which welfare conditions might be built up, and which made definite recommendations as to the kind and extent of welfare work that seemed requisite in each case. In due course officers were lent from the Factory Department, Dr. Collis as Director in succession to Mr. Rowntree in 1917, and Miss Squire, O.B.E., as Director of Women's Welfare in 1918, and under their direction extensive plans were begun and officers appointed for development of outside welfare of munition workers, more especially for recreation and maternity and infant welfare. . . .

Lastly reference must here be made to the valuable and important outside welfare work in connection with housing and lodging of munition workers effected first by the Hostels Department of the Ministry of Munitions and later, from 1917 onwards, by the Billeting Board set up by the government. This lies outside the direct concern of the Factory Department but inevitably good progress in this direction had an intimate connection with problems of feeding and general care of the health of the factory worker.

During the war while the new departments set up large staffs for the new kinds of duties the Factory Department remained simply expert advisers as regards conditions in factories without any net increase in staff. Many of the men inspectors either joined the forces of the Crown or were lent for special duties in other war-time departments. On the other hand, additions were from time to time authorised to the women's branch by the appointment of temporary inspectors who gave us much valuable help. They numbered, for general inspection, fifteen salaried and four voluntary. . . . For the special technical help needed in administering the first-aid and ambulance orders, appointment was further authorised by the Treasury of three specially qualified women, and they have been at work during the greater part of 1918.

Orders under the Act of 1916 and Explanatory Pamphlets

The first Welfare Orders made under the Act of 1916, in October, 1917, came into force on December 1st of that year and they tested in an interesting way some of the varied methods of applying the welfare provisions allowed for in Section 7 (3) (a). One, the order affecting factories in which the *manufacture of tin or terne plates* is carried on, applies to a distinct class of factories with hitherto a rough and heavy class of work, and requires the provision of several means of health and comfort: protective clothing in pickling and wet processes (all persons), with simple cloakroom (all women and girls), messroom and washing facilities (all persons), under responsible supervision for maintenance and effective use. Another, the order requiring conveniently accessible supply of wholesome *drinking water* in every factory or workshop employing twenty-five or more workers, secures a fundamental condition of health and well-being for every description of workplace under the Act in all those cases where special arrangements for it are most necessary, and liable, if difficulties arise in getting the supply, to be sometimes neglected. Another, the order in regard to *ambulance and first aid* arrangements at *blast furnaces, copper mills, iron mills, foundries and metal works*, applies modern remedial and preventive first aid in case of injury by accident for all workers in large classes of factories where such accidents are most liable to arise in large numbers.

This last named class of provision for welfare was extended towards the end of 1918, by another order, to *saw mills and factories in which articles of wood* are manufactured and where also risk of accident is

widespread and large numbers of workers, in normal times chiefly male, are concerned.

Two other orders, made early in 1918, apply in two industries to a special class of process where the nature of the work carried on is "such as to require special provision to be made for securing the welfare of the workers"; these are the processes where *bichromate of potassium or sodium* are used in (a) *dyeing* (other than job dyeing) and (b) *tanning* by the "*two-bath*" *process*, and the welfare measures required include: protective clothing, first aid, suitable accommodation for clothing put off during working hours and arrangements for drying it if wet, simple messroom arrangements and washing facilities, under responsible supervision for maintenance and effective use. In a third special group of industry: manufacture of *glass bottles or pressed glass*, similar welfare measures (omitting first aid) are required, and the supply of wholesome drinking water is required whatever the number of workers, as this is a branch of industry where, great heat being inevitable, the need is always paramount.*

Lastly an order made in July, which came into force in August, 1918, applies to a particular group of munition factories, those engaged in the process of *turning or machining shells or shell bodies*, a requirement as regards female workers of facilities for sitting, "so as to enable them to take advantage of any opportunities for resting which may occur." . . .

The power given in sub-section 7 (9) to the Secretary of State to extend the scope of the whole section to matters additional to those enumerated in 7 (2) has been exercised and provision of rest rooms may now be required since April 16, 1920.

. . . As yet no direct requirement has been made by order for welfare supervision of workers, only incidentally for the care of messrooms, washing facilities and cloakrooms. Nor has any order yet required the setting up of a canteen, or provision for preparing as well as heating and taking of food. The Home Office has however prepared the way for requiring canteens, where needed under peace conditions, by issue in 1918 of a pamphlet on *Messrooms and Canteens at Small Factories and Workshops* (4). . . .

The pamphlet on *Protective Clothing for Women and Girl Workers*, issued in 1917 (5), by its thorough, classified tabulation of industries and processes, showing the need in each instance for typical kinds of protective clothing, and the reasons, makes the future steady extension throughout factories of this kind of measure for health and welfare a comparatively simple matter. The almost universal use of suitable uniform or protective clothing during the war throughout munition factories, affecting hundreds of thousands of women and girls, has inaugurated a new point of view and habit in this matter. . . . Orders where they require provision by the occupier of protective clothing simply enforce on all factories in a trade or process what is already customary in some of them.

A far wider pamphleteering piece of work in aid of development of welfare was actually undertaken and carried through by the Home Office, in 1916 and 1917, when the need was paramount for the replacement of men by women on a large scale in factories to set free as many men as possible to join the colours. The foundations of this work were laid from the spring of 1915 onwards when conferences between employers and employed were arranged, in a number of non-munition industries, under the chairmanship of factory inspectors, to negotiate and lay down in signed agreements the conditions under which women and unskilled labour might be in-

* Since the above was written orders for various welfare requirements have been made in the following industries: preserving of fruit; oil cake mills; laundries. Orders are in draft for: gut scraping; manufacture of hollow-ware and process of galvanising; gutting, salting and packing of herring.

troduced into men's skilled and semi-skilled operations. As these progressed, and women came in increasing numbers, the need of safety, health and welfare precautions, adapted to their needs and frequent inexperience, became evident and in some cases were suggested in the agreements. Then to assist and extend the practice of substitution it became clear that published records of the actual substitution, process by process and occupation by occupation, would be of great practical value to employers. There followed the rapid publication in 1916 of a series of pamphlets on the substitution of women in industry for enlisted men, prepared by the Home Office and Board of Trade, and a prominent feature in these was the indication of advice as to arrangements necessary for the health and welfare of women and girls in processes and surroundings entirely new to them. A new edition embodying the results of experience was necessary at the end of twelve months and the second edition was published in December, 1917, covering additional trades and bringing the total number up to twenty-seven, including many thousands of processes against each of which was indicated the main precaution, if any, specially necessary. Although much further substitution of women for men in increasingly heavy occupations (involving increased vigilance as to necessary safeguards) followed in 1918, in the military crises of that year, the new occupations were mainly of a labouring type, not skilled processes, the immediately practicable limits of which had already been attained. Thus the second edition of twenty-seven pamphlets (6) covering all kinds of textile and non-textile industries remains a permanent record, both of the remarkable extent of substitution effected and of typical kinds of welfare precautions then deemed necessary and practicable. Many of the latter provisions obtained legal force, since special emergency orders were requisite to allow deviation from normal Factory Act requirements as to hours and times of work, and to these the Home Office attached — as it did to the General Munitions Orders — conditions as regards welfare.

When speaking of the new Home Office method of spreading knowledge and advice about welfare during the war by means of pamphlets, it should be recalled that from the autumn of 1915 onwards the Health of Munition Workers' Committee were rapidly issuing their valuable memoranda on different branches of welfare work, and that these in addition to their appeal to the most thoughtful employers reached a wide, general, reading and thinking public, to whom the brief direct and practical instructions of the pamphlets would be far less interesting than they were to employers. Thus on all important sides the new welfare movement was winding its way into ever widening channels.

Returning to the most recent work of the inspectors under the Act of 1916 in the year 1918, many studies and enquiries have been or are being made, and reports have been submitted in 1918 as regards a wide range of non-munition industries. Some of the proposals and suggestions run on similar lines to those indicated in orders already made, some point to the possibility of new experimental measures under the powers given by sub-section 7 (2) of 1916. . . .

Further Welfare Orders that are in preparation or actually in draft in consequence of enquiries and reports relate to the following industries: the hollow-ware and galvanising, and gut scraping industries. Reports are under consideration in the india-rubber clothing and fish-curing industries. Enquiries are generally in progress in various textile industries, aerated water factories, and throughout all these and other industries it is clear that a varying proportion of the factories are already

introducing some of the amenities that will in due course be made applicable throughout.

Observance of the Orders

Reports from the inspectors show marked progress on the whole in observance of the orders already made and a widening and deepening interest, particularly as regards the larger factories, among employers and workers in general betterment of hygienic and social conditions of welfare. The interest taken by many employers in the terms of orders not yet applied to their industry is great. They ask for copies and voluntarily comply, some because, they say, it is only a matter of time before the order will apply, others because they wish to do more than the law requires. "Even small firms have made some attempts in this direction" in some parts of England, although in them nearly the whole work of co-ordination yet remains to be attempted, and in some directions "progress is by no means as general as the inspectors would like to see it" (Mr. Wright and Mr. Williams). In the small clothing factories and workshops, largely occupied by Jews, in great centres such as Leeds and East London, there is a far lower standard of personal welfare than in the great clothing factories where much good work has been done and often a high standard has been attained by voluntary action of the employers. In the smaller workshops, both Miss C. Smith and Miss Taylor point to the practical necessity of grouping occupiers (and this is necessary, generally, for tenement factories) as regards responsibility for messrooms, cloakrooms, etc., under common provision for superintendence and maintenance. Associations of employers all over the kingdom are progressing in careful study of the whole question and stimulating their members to make practical experiments. Workers are becoming "keenly alive to the value of improved and more comfortable conditions and also to the powers of the Secretary of State to make Orders" (Miss Slocock), and in many of the larger works "Welfare Committees have been formed to deal with such questions as lavatory and cloakroom accommodation, canteen arrangements, rest rooms and library" while often "a social or amusement committee arranges for concerts, etc., to be given," and where the arrangements are "left in the hands of the workers' elected representatives these schemes are generally successful" (Mr. Jackson). Boys' clubs have been established in some of the most progressive larger works, in which, in addition to the usual "recreation and educational schemes, there are classes for physical culture and for ambulance classes." In some cases a medical officer as well as trained nurses are engaged in steady health work additional to administering first aid, and while the appointment of a superintendent or supervisor of all the welfare work of a factory is far more general in the case of women and girl workers, still the appointment of trained men to look after the general welfare conditions for men and boys has begun and is progressing. In the South-Western Division, less highly industrialised than other divisions of the kingdom, the existence of these male officers is reported in thirty factories, most being whole-time officers. In some cases they visit men and boys who are ill, "consult with them as to difficulties in their work and bring any grievance to the notice of the management, obtaining lighter works for boys who are too weak for their assigned tasks . . . some of the supervisors engage all boy labour and others are responsible for securing compliance with certain requirements of the Acts, *e. g.*, hours of work and certificates of fitness. They act in close association with works committees where such exist" (Mr. Rogers). In a large factory in the Midlands, with excellent welfare conditions, "conciliation

boards have been formed to deal with disputes as soon as they arise," the result attributed to this is "absence of any labour trouble in the factory." (Mr. Harston). . . .

In Lancashire, in the highly organised cotton textile industry, with a primitive, traditional standard in arrangements for personal hygiene . . . neither manufacturers' associations nor operatives' unions appear before the war to have concerned themselves with the fundamentals for welfare, first authoritatively enumerated in the Act of 1916. Miss Pease comments on the valuable enlightenment in this matter effected when 1,300 women cotton operatives were recruited for a large, well-provided munition factory, in a district, where she had "found women taking their meals while sitting on the floor of a gassing room and apparently liking it." She says: "Several large firms have now planned extensive improvements though prevented from carrying them into effect under wartime conditions." . . .

In Ireland where there have long been several factories with remarkably good welfare arrangements there has been little progress to note in 1918, or preceding years during the war, outside the few munition factories — now closed down. In certain controlled works no serious attempt was made to fall in with advice from the Welfare Department of the Ministry of Munitions as to conditions of welfare and the general tendency has been to await the application of legal welfare.

In the dressmaking and allied trades, in the special West London district, Miss Stevenson reports a marked change in the outlook on welfare measures, especially as regards workrooms connected with large retail shops. The agreement, chiefly as to hours, recently made has helped to organise the trade on more human lines; in several instances shop committees have been set up through which suggestions and grievances can be brought to the knowledge of the management. She says:

> Welfare work in West End establishments is hampered by lack of proper buildings. Nearly all the large firms have schemes for rebuilding which have been stopped by the War, but which are now due to be carried out. These schemes almost invariably include canteens, recreation and rest rooms. In my opinion the recreation rooms are essential, as in London almost all the workers wish to remain in the canteen for dinner and it is impossible for accommodation to be provided for all at once. The meals must therefore be allowed in different parties and if one hour is given for dinner, in order to make room for others the workers must either return to the workrooms or go out into the street, both equally undesirable. In some cases this difficulty is overcome by allowing only half an hour for lunch, but there is no doubt that at least three-quarters of an hour is advisable as a dinner interval.
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> There is great need for efficient welfare workers in these large West End houses. The present system consists of each section being in charge of the fitter, who is an autocrat in her own department and brooks no interference. The state of the rooms, therefore, varies according to the temperament of the fitter — being clean, if she has theories on the subject of cleanliness, but not otherwise; warm, if she likes heat and so on. She engages her own workers, so that it is difficult for the firm to ascertain whether, for example, certificates of fitness are being obtained, or if the young persons are attending school regularly. The general arrangements as to cleaning and upkeep of messrooms, passages, lavatories, sanitary accommodation, etc., are in the hands of charwomen and cooks, and are not under any one definite person's direct supervision, unless it be the workroom manager, who is content so long as he receives no direct complaints. The result is that the messrooms are gloomy, dingy apartments, and the sanitary and lavatory arrangements are old-fashioned and only fairly well kept. Apparently no progress has been made in the last 10–15 years. In one instance, where an experienced welfare worker has been appointed, a great change is evident. There is co-ordination throughout and the general standard is rapidly being raised. It is to be hoped that, when the other firms rebuild, they will appoint really efficient people to superintend the comfort of the workers, or however well they start, they will gradually lapse again into the same unsatisfactory state.

The widespread network of governmental control, financially and otherwise,

during the war, of a great number of staple industries — not previously thought of as connected with munitions of war — has meant the general introduction into them, through visits from welfare officers of the Health and Welfare Section of the Ministry of Munitions, of modern ideas on betterment of conditions surrounding workers. Even where little has been actually attempted the ground has been in a sense dug and prepared, and even seed sown, to a wide extent. Many of these welfare visits took place in the later stages of the war when material and labour were hardly available for structural alterations. The Factory Department is none the less strongly reinforced for its coming activities under the Act of 1916, by this preliminary crusade of ideas. Among many important industries affected in this way may be mentioned paper making, leather equipment, asbestos manufacture, soap making with its incidental glycerine production, oil seed and cake making, clothing, in addition to many branches of textile industries. . . .

In Scotland Mrs. Shaw says that "the belief in social betterment which is permeating all classes has been definitely helped by the mixture of classes in the factories. The middle class worker has demanded a minimum of good conditions, and everywhere the pressure for hygienic betterment is increasing and is being recognised."

A large special chapter might be written on the varied forms of recreation and entertainment developed under the fostering care of the Canteen Committee (Central Control Board) as well as by individual enterprise of firms and works' committees in munition factories during the war. In some of these a hall, equipped with a stage, artists' dressing rooms and a buffet, is provided for entertainments, lectures, dances and so on.

In a Glasgow engineering factory red blaize tennis courts are provided in which the employees play on Saturday afternoons, bringing their tea with them which they make in the canteen left open for their use. At this works there were also dramatic and choir classes in the winter evenings. An interesting innovation at one of the Glasgow east-end textile mills has been the inauguration of a series of lectures by the Works' Committee, attended during working hours: the syllabus of lectures included such subjects as "Quality" and "Discipline." Workers are paid for the time spent in attendance at the lectures. (Miss Vines.). . .

Certain engineering firms have acquired small homes on the west coast, which they maintain for those of their workers who become run down or require a rest and change. One progressive firm has arranged week-end camps for their apprentices, and the boys are given simple lectures on botany and geology when away. In isolated works in rural areas employers have recognised the necessity for recreation, and in connection with one large factory in a remote village in Scotland there is a cinema run by a small Committee of the workers, an angling club, a tennis court, and bowling green. The cinema is particularly popular and always well patronised. A firm of engineers on the Clyde gave up a considerable area of waste ground, previously unused, round the works, to their workers for allotments or other purpose. The experiment proved an unexpected success, the plots were sedulously cultivated, vegetables and flowers grown, and a tennis court constructed by the men in their own time. A successful flower show was held at the end of the season, and several men who previously had had no opportunity of cultivating any ground whatever, living in Glasgow tenements as they did, maintained that they would not give up the allotment now on any account, they had no previous idea that the growing of a few vegetables or flowers could give so much interest and pleasure. (Mr. Wilson.)

One large firm employing several thousand hands has built and run a fleet of motor buses to carry their workers to and fro within a ten-mile radius as the train services did not meet all their requirements. They also purchased an estate within easy access of the works and built houses on it which were let to the workers. A technical society with 750 members, owning a free library, was established in connection with the works and lectures on technical subjects given at frequent intervals. Eleven acres of playing fields were provided, and athletic, hockey and football clubs formed. There were organised two works bands, an orchestra, a choral society and two cinema theatres, and when night shifts were worked the services of artistes from the Birmingham theatres were obtained. The firm also provided eleven pianos and seven billiard tables for the entertainment of the staff.

Another firm in addition to providing a well-equipped surgery, has started a dentistry department in which workers are given advice and treatment at special rates. (Mr. Harston.)

The detailed results actually achieved at the close of 1918 in factories as reported by the inspectors are as follows:

Drinking Water. — The inspectors generally show that as regards adequate supply of wholesome drinking water the requirement of the order in most factories in large urban centres was already forestalled, and that it was mainly in getting the further details carried out that their work there lay. In places like Birmingham and Coventry, in the South-Eastern Division and in some towns of Scotland and elsewhere, employers showed a preference for the upward jet system. The workers are not unanimous in liking this method; some do so but others have a prejudice against using it still to be overcome. Mr. Wilson reports a considerable extension of installation of such "bubblers," and lays stress on its being the only really suitable method in all trades that are essentially dirty, such as oil refining, grease extraction, fish-manure making, where it is practically impossible to keep a drinking cup or receptacle free from contamination; to a less but also important extent this consideration holds good in hot and dusty trades. In cotton mills, Mr. Jackson points out that the point of supply was very generally out in the yard, and that clearly this is not suitable for workers coming, especially in cold or wet weather, from heated rooms and sheds. In such works also a problem has arisen as to what constitutes an adequate number of points of supply, for, it is pointed out, a simple standard of numbers does not cover the whole problem where circumstances vary widely. Provisional agreements are being made and carried out so as to test this point. "In one case of a large iron works where over 1,000 workers were employed, water was supplied from one tap near the gate, and an almost continuous stream of boys bearing buckets to the different parts of the works was the result." (Mrs. Shaw.)

The case of the country factory is generally very different from the town factory, and in rural districts there have been, relatively, both much more work to do and difficulties to overcome than in urban districts in England and Scotland. In some parishes the only source of supply is still the village pump. . . .

The reports of the inspectors show much pre-occupation with regard to use of receptacles, buckets or other vessels for supply of drinking water to different parts of a factory. Most consider them to be always objectionable and not permissible at all where there is heat or dust. Generally, opposition has been expressed by employers and workers to the idea of a common drinking cup as unhygienic. Most workers prefer to use their own cup.

Canteens and Messrooms. — Under this heading far more has to be said of progress by voluntary action and under special war-time arrangements . . . than has yet been effected by orders under the Act of 1916. It does not fall within the scope of this report to give a review of the great work accomplished by the labours of the Canteen Department of the Central Control Board . . . in controlled munition factories — and later by the Food Section of the Minister of Munitions with the help of grants in aid of building from excess profits. Reference to it cannot, however, be omitted here for not only was it probably the most decisive factor in enabling the munition workers to sustain the fatigue of their intense toil, but it has effected a changed outlook throughout industry on this question of arrangements for meals on or near factory premises, and in many cases with improved dietaries for workers. The Home Office insistence from the outset in its emergency orders, general and special, and for

non-munition as for munition factories, on the obligation to provide proper and suitable means for heating and taking meals on *night shifts*, has also had great effect. Miss Lindsay says that in the North-Western Division practically all the firms went beyond providing means of heating food and provided proper cooking facilities as the workers all preferred it. "It is usually only lack of suitable opportunity which has made the worker apparently content with warmed-up food. This applies particularly to the night shift when appetite is not so keen." . . . Miss Taylor found on consolidating her information that 84 per cent. of clothing factories in Leeds, employing 100 or more persons, have generally good messroom accommodation. "Taking the trade as a whole and including the large number of quite small factories, 64 per cent. of the women are employed in factories which have messroom accommodation." . . .

Considerable progress was already reported in 1917 as regards compliance in a simple homely way with the messroom requirements of the order applicable to tinplate works. Some firms, however, submitted large plans of construction with high class arrangements under the scheme for application of excess profits. Difficulties followed through the war-time shortage of materials and labour which greatly delayed progress. Mr. Rogers says: "The majority of firms have either complied fully with the order or have provided temporary accommodation, but some have done little if anything and action is being taken to secure compliance." Similarly Mr. Wright records that the order applying to factories in which bichromate of potassium or sodium is used "has been well received and no difficulties have been met with in its application." In the glassworks good progress is also being made, the emergency order having already made permission to employ women at night conditional on provision by the occupier of suitable means for preparing and taking meals.

In brickworks where provision of messroom accommodation was required among other welfare measures under the emergency order allowing employment of girls under 16, Miss Meiklejohn says that the arrangements are sometimes far from satisfactory and that the reason is in the intermittent employment of the girls. One or two firms, however, have made good arrangements which have been well used; "others have done nothing beyond the building of a very small messroom with a fireplace and without any facilities for preparing meals."

Miss Slocock gives a pleasant account of the pains successfully taken in a small, old woollen mill, in the country outside Bradford, to give workers who stay for meals good food in comfort.

> An old low mending room, with the use of lots of white enamel paint and addition of extra windows, has been made into a most excellent canteen with a kitchen for light refreshments at one end and small rest rooms for men and women at the far end. The dinners are sent down daily ready cooked in vacuum containers from the main works and are said to arrive in excellent condition and very hot. All the 140 workers take breakfast in the canteen which is fully equipped, and quite fifty take porridge every morning. One hundred and thirty stay to dinner, a very large proportion taking the full dinner. Tea is taken round to the workers during the afternoon. Washing accommodation with hot water laid on is now (in 1919) being installed in the factory and numbered pegs for clothing for each worker. . . . The occupiers are very good in allowing other manufacturers to see what they have been able to accomplish. . . .

Protective Clothing and Cloakrooms. — The present position in this matter somewhat resembles that just indicated as regards messrooms. The first administrative step was taken long ago by the Home Office when regulating dangerous and injurious trades, and many of the special codes laid upon occupiers the obligation to protect the workers by overalls, etc.,

against poisonous or irritant dusts, excessive wet and (as in aerated water works) against injury by accident. Factory inspectors sometimes further secured, by persuasion of employers, protective clothing for women exposed in various processes to wet or dirt. A new outlook as regards widespread equipment of women and girls with suitable working clothing, and the necessary consequential cloakroom accommodation, was, however, introduced during the war by their universal provision in vast national munition factories and very general similar provision in great controlled munition and allied works, under the guidance of the Welfare Department of the Ministry of Munitions. Since approximately 100,000 women and girls have been for a considerable period used to the comfort and convenience of trim and cleanly protective clothes as a part of working equipment the situation is bound to be changed, as their own view is, when they return to their pre-war occupations. The thorough survey of the industries and processes in which typical forms of protective clothing are requisite, given in the Home Office pamphlet on *Protective Clothing for Women and Girls*, issued in 1917, turns the whole new attitude to practical issues by putting into the hands of the enlightened and well-disposed manager and employer a simple, direct guide to the best way of falling in with the new demand of his women workers for personal working equipment. If he wants more, or more concrete, guidance, he has only to apply to one of the lady inspectors to be shown sample forms of clothing for the typical kinds of risk or inconvenience to be guarded against. It was noteworthy how great was the interest aroused in this matter by the display on lay figures, at the Whitechapel Exhibition in October, 1918, . . . of the main kinds of suitable clothing for wet, hot, dusty, dirty, etc., and dangerous processes, including exposure to acids, burns, and spark-emitting processes. Both workers and employers gave a great deal of attention to that particular exhibit, furnished by the Factory Department. . . .

In spite of great progress, very much however still remains to be done. As regards textile factories, Miss Meiklejohn's experience in jute and flax factories as follows is similar to that of inspectors in other textile works:

> In visiting the jute and flax works in Dundee district, I have been impressed with the desirability of providing cloakrooms especially for workers in dusty processes. The chief difficulty is the lack of space in existing works. At present workers keep their outdoor clothing in the mill sheds — a few wear overalls and fewer still head coverings. Some employers tried providing protective clothing but the women objected to head coverings probably because they were of too thick material. If there were good cloakroom and washing accommodation it should be possible to raise the standard and to get the workers to wear protective clothing, as I think the two things generally go together. One jute factory (weaving) has fitted up an excellent steam heated cloakroom with washing accommodation (hot and cold water, etc.) in what was formerly an engine room. There is no attendant in charge but the women take a pride in keeping the cloakroom clean and tidy, and it has incidentally had a good effect in raising the standard of the more careless and untidy workers. In a spinning and weaving mill one central cloakroom would not be convenient, as being too far from the different departments, and also because the spinners and weavers do not readily mix. The only other instances of cloakroom accommodation, which I have found in the jute and flax works, are space for hanging clothing between the flats and sanitary accommodation, and in a large weaving shed the provision of cupboards or lockers all round the shed — each weaver having her own locker.

Facilities for Washing. — No order yet governs this matter as a whole, and legal requirements exist only, as of old, in codes of regulation for dangerous trades, under Section 75 of the Act of 1901 (which requires such provision in every factory or workshop where lead, arsenic or any other poisonous substance is used), and recently as a subsidiary clause in the welfare orders

for tinplate works, in certain factories where bichromate of potassium or sodium is used and in factories or parts of factories in which the manufacture of glass bottles or pressed glass articles is carried on.

A remarkable fact, on which more than one inspector comments in 1918, as in many previous years, is that existence of dirt alone as an unavoidable feature in a factory, *e. g.*, in rag sorting, sack repairing, gut scraping, has not yet been recognised by occupiers generally in the past as a ground for fitting up good washing appliances. In fact, as Miss Escreet says, this provision has sometimes seemed to be made by them "in inverse ratio to the need." A very considerable step forward has, however, been taken during the war by the almost universal provision of more or less good lavatory conveniences often with hot and cold water, towels, soap, etc., in controlled and always in national works in which engineering processes are carried on.

> As building facilities increase undoubtedly washing accommodation will be made a part of any sanitary re-building schemes undertaken by most firms. . . . There is still a very prevalent idea that a basin and a cold water tap constitute washing facilities. . . . It is true, however, that the hot water geyser is becoming more and more a feature of works lavatories and the provision of soap and towels is common. The most pleasing fact is that extension of this provision from clean trades to the more dirty is beginning to appear. (Miss Escreet.)

Miss Vines commends extension of provision of baths in various works and was glad to find in a large food factory that six bathrooms with cubicles attached were being erected.

Ambulance and First Aid. — A somewhat remarkable reception and widespread welcome has met these orders, from employers, managers and workers. Much had already been organised in many industries for a considerable time before the war, and during the war especially in munition works, in advance of the making of these particular orders. In a great number of cases in 1918 the work of the inspectors has lain in application of the details rather than the principles of the orders. The advice as regards methods that the technically trained first aid inspector could give has been widely valued by the employers. It seems that there are many more occupiers who are surprised that the orders do not yet have legal force in their works than those who fail to carry them out in works where they do apply.

> Occupiers and workers alike consider the legal requirement a reform long overdue. . . . The Chairman of the Birmingham Bench of Magistrates commenting on the first cases taken into court under one of the orders expressed this view forcibly and the heavy penalties then inflicted are an index of the importance attached to the provision. . . . In an engineering works I was seized upon by a workman engaged in very dirty work who produced from his pocket a newspaper cutting about the order . . . and said "now perhaps I shall get my opportunity at last." He was the "First Aid" man, whose only appliances hitherto had been a few rolls of bandage and whose "surgery" had consisted of a very dirty tool room bench. The firm have now (although not employing 500 persons) equipped a small dressing station wherein all appliances mentioned in the order are kept. The provision of ambulance rooms and first aid appliances is undoubtedly spreading in industries outside the orders. Well-equipped surgeries are now found in clothing works, rubber works, rope and twine works, and it is the exception not to find first aid equipment in gas works, breweries and other places where women are largely employed as labourers. (Miss Escreet.)

Boot and shoe factories, biscuit factories, bleach and dye works, cotton textile and other factories are mentioned by various inspectors as equipped with first-aid outfit.

> In Dundee I found all the jute mills provided with first aid outfit-cabinets similar to those required under Home Office Orders. The provision has been made voluntarily in accordance with the advice of the certifying surgeon. One works has first aid classes for the women in winter time, and many of the weavers take the course and sit the examination. The knowledge they gain is often useful to them in their homes, even if they are less likely than the men to have it tested at the works. (Miss Meiklejohn.)

The distribution of the orders, to all the works in the divisions known to fall under them, has lain with the district inspectors — who already had done much preliminary preparation of the ground by issuing copies of the Home Office First Aid Leaflet (Form 923) and by systematic following up of reports from certifying surgeons on cases of sepsis.

The standard of compliance with the terms of the orders is already, in consequence, much higher than would otherwise have been the case. In the majority of the works under the orders first aid equipment of a sort has been provided for some time. . . . In many works the dressings, etc., were kept in dusty cupboards or drawers containing other articles and dressings were obviously not kept sterilised. . . . The provision of ambulance rooms has received special attention. . . . In a few cases delay has arisen through shortage of labour or materials, but these difficulties are being overcome. In about half a dozen of the largest works (in the S. W. Division) the ambulance rooms are in charge of a resident medical officer and full-time attendants. Either nurses or trained first aid men are at other large works. (Mr. Rogers.)

Similar accounts are given in other divisions. In the S. E. Division Mr. Williams, and in the N. E. Division Mr. Wright, add that in some of the smaller factories arrangements were not satisfactory, and that better progress has yet to be made: in some cases occupiers had taken no steps to comply with the order until reminded by the inspectors.

In the N. W. Division, Mr. Jackson thinks there is a falling off in the cases of septic poisoning, and in the N. E. Division Mr. Wright says that the keeping of records in ambulance rooms has awakened very many to the great magnitude of smaller accidents that occur. Mr. Harston, in the Midlands, refers to the great extension during the war in controlled works of good provision of ambulance and rest rooms and appointment of trained nurses and qualified medical attendants, before the orders. . . .

Some inspectors comment on the small amount of training found among persons in charge of first aid boxes and the absence as yet of any great movement for forming classes for such training. At the same time good instances are given of inauguration of courses in Huddersfield, Sheffield and elsewhere. Mr. Wilson says that the opinion of inspectors in the Northern Division is in favour of trained women attendants for ambulance rooms rather than men.

They keep the appliances and the rooms neater and cleaner and are very deft and gentle in dressing wounds. Having had some experience of both I rather take the same view, particularly if the attendant has had a year or two of hospital experience. The contrast in general method, in neatness and cleanliness of a modern ambulance room under the care of a woman with some hospital training and one attended by a man, with even considerable first aid experience, is very marked indeed, and all in favour of the former.

Rest Rooms. — Except as an adjunct to ambulance rooms and messrooms, the inspectors do not in 1918 generally refer to development of this new feature in certain directions in factory life. Mr. Harston, however, reports that they are not uncommon with libraries attached. The inspectors have in previous years — both during and before the war — pointed to the value of rest rooms, in enabling young workers, especially, to recover from slighter ailments or passing faintness. I have personally in munition and aeroplane factories observed and been struck by their usefulness for women workers where the nature of the work is continuous and does not allow of sitting at all during the working spells. A highly-skilled woman, in charge of a gang of women engaged in fitting aeroplane wings with certain metal appliances, told me that she and her women had, with the aid of a rest at the end of a spell, developed power to work standing without injury and apparently with benefit to health.

The development of the factory rest room in connection with cloakrooms, as well as with ambulance and messrooms, in national factories, and, under the guidance of the Welfare Department of the Ministry of Munitions, in controlled munition works, is a matter of common knowledge. It is a valuable aid to future administration by the Factory Department that this institution in aid of the well-being and energy of workers should have been so widely advertised and used during the stress of war production.

Supply and Use of Seats. — Relatively little advance is reported in 1918 in this condition of health and efficiency, and on the whole the position has not markedly changed from earlier years. The experimental order for supply of facilities for sitting, for all women and girl workers engaged in shell-making, was much needed and very useful, but as it came into force only on 1st August, 1918, and shell factories closed down rapidly after November 11th, it had but a short course to run. In many factories compliance was secured and seats were in use, in others supplies of seats were coming in when work began to cease. It was, says Miss Vines, greatly appreciated in Scottish factories.

Miss Lindsay says that in the shell factories in the N. W. Division the main objection was made by firms who thought that the order meant that the work should be done seated, and that they withdrew the objection when they realised that seats need only be available for use as opportunity occurred. No doubt this has been a frequent misunderstanding and cause of opposition to legal regulation of the matter, but from reports of welfare superintendents, as well as communications from managing directors themselves, it is clear that there is still some opposition to remove, finally, that is based purely on an idea among managing foremen that proper discipline requires the worker to stand, more or less "at attention," throughout working hours. Manufacturers themselves show more favour to provision of seats sometimes than their foremen.

Miss Martindale comments on the disappointingly slow progress in development of useful kinds of factory seats, suitably shaped and easily adjustable and of suitable materials. This slow process is perhaps rather natural until a sufficiently wide demand for the seats is forthcoming. The issue in due course of the Home Office pamphlet on this question will strongly reinforce and extend the wiser councils that hold even now among many employers. Admirable arrangements have, in fact, been made by those who realise the value of saving energy and preventing needless fatigue and who know that access to occasional rest does not "encourage laziness and lessen output" if properly organised. . . .

Supervision of Workers. — This is the last in the specified list of subjects in the welfare section of the Act of 1916, and as yet no order has been made under that section for supervision of workers as distinct from conditions. In national munition factories, and to a very wide extent in controlled factories, under the guidance of the Welfare Department, Ministry of Munitions, and in pursuance of memoranda of the Health of Munition Workers' Committee this means of initiating and guiding development of welfare held a very prominent position. Time being of the essence of the matter in production of munitions, naturally personal development, at the works, of means of welfare, was bound to be rapidly used while various more concrete conditions were being forged out and tested. This is clearly seen also in the general emergency order for relaxation of hours in munition factories first issued by the Home Office on 31st March, 1915, and revised, September, 1916. The requirement there of personal supervision of women and girls on night

shifts by a competent woman was carried over into other Home Office emergency orders that followed, and was a prominent feature in the order for brickworks, allowing the employment by day of girls under 16 years of age. An extraordinary impetus was given to training and growth in number of candidates for this relatively young branch of social welfare, to which I make further reference below.

Although under the Act of 1916 supervision of workers is not yet required, and its decisive development has been mainly under voluntary guidance and emergency requirements, yet a beginning of expert supervision of conditions affecting workers' health and welfare is provided for in the tinplate factories and other special cases to which welfare orders applied in 1918, and in further draft orders issued in the current year, *e. g.*, to laundries, fruit preserving, and oil and seed cake factories. In all of these, cloakrooms, washing facilities and messrooms "shall be placed under the charge of a responsible person and shall be kept clean." In this provision lies a sure ground-work or starting-point for building up of expert management of material conditions for the welfare of workers at the very time when workers' welfare committees are springing up in many places and can effectively co-operate, and not least by expressing the workers' needs and wishes in these matters.

In the most important divisions as regards production of munitions, the superintending inspectors all report in 1918 on the numerous appointments of men and women supervisors in the larger factories.

> These officers concentrate on working conditions, recreation, sport, rest. . . . In occasional instances they have arranged for lectures by managers and foremen during working hours and the latter part of mealtimes. The interviewing of applicants for employment and the forwarding of a quarterly report to the parents of boys is also undertaken by some of these officers. (Mr. Wright, N. E. Division.)
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> Last year . . . many new appointments of women and men supervisors were made. . . . Large numbers of women have been appointed during the war to organise and control welfare work in factories and the experience of the benefits following these appointments has shown to employers the desirability of extending the principle to boys and, in a measure, to men. (Mr. Rogers, S. W. Division.)

The tremendous changes effected in industry by war have brought the whole problem of skilled supervision of conditions in factories forward, into a new aspect, with rays of light bearing upon it. When the first meeting of social secretaries and welfare superintendents was convened at Bourneville in 1906, by employers who had for long been among the chief leaders of the idea of skilled supervision, industry was still held fast in its predominantly economic framework. Welfare work in the main had to be justified to the average employer as a humanitarian or philanthropic movement on the one hand, or as a direct matter of efficiency in output — a sound business proposition — on the other. In the great movements, by tens of thousands of workers, to and inside munition factories, followed by the highly specialised campaign for dilution and substitution of women in all industries, supervision emerged in its new light as essentially both leadership and true management. And that is why in various quarters it failed, and was adversely assailed, where it still tried to continue and survive as a merely superimposed factor on unreformed factory life. The workers knew very well where the shoe pinched, and that welfare cannot be either a graft or veneer on poor or bad conditions. They have valued and welcomed supervision wherever it came in as a new art of factory life, and the supervisors when they were equipped with scientific training and with good experience. Dr. Collis, speaking at a public health conference at the Royal Sanitary Institute early in the current year, estimated the total number of women welfare workers of various grades appointed

to care for women and girls as approximately 1,000, and for boys as 400. In these numbers, so rapidly increased from the few hundreds at the beginning of the war, both the great need of such workers can be seen and in some degree the cause of failures among them. And yet, when the total number of factories is considered, the movement may be said to be still in its infancy.

The Home Office pamphlets and *Memorandum on Substitution of Women* indirectly bring out the great significance of the new managerial side of supervision by women in factories. And this is the side on which it is impossible not to be impressed, as Miss Martindale says, with the need of supervision of a kind that will secure "faithful and careful carrying out of all the necessary regulations and ensure general welfare of the workers." . . .

Miss Escreet has, in the Midlands, had wide and varied experience of types of welfare supervision and she shows that there are more ways than one of securing active co-operation from the workers:

> We have come across many opinions with regard to welfare supervisors, but even those occupiers and workers who dislike them most have to admit that they always have the messroom and lavatory kept clean. The supervisors themselves would claim this of course as the most elementary of their duties, but factory managers have had to learn that what is everybody's business is nobody's business, and that messroom and lavatory equipment gets out of order if it is not regularly attended to, just as machines and boilers do. They do not always realise that it is the responsibility for seeing that work (*e. g.*, cleaning) is done, that is the important thing. An instance of the members of a works' committee taking real responsibility was found by Miss Hutchinson at a factory in Wales. The women members of the works' committee were responsible for supervision at night under the General Munitions Order and were paid extra for this work. The supervision was carried on in a thoroughly systematic manner and the arrangement appeared perfectly satisfactory. At one factory where Miss Mellor found the messroom and lavatory unusually well kept the work was carried on by means of a "monitor system," adopted after the rejection of a welfare supervisor. Three girls had been chosen as monitors and were responsible in weekly turns for discipline in shop and messroom for the cleaning of the messroom, etc., and for general matters concerning the women employed. The monitor on duty received extra payment, and the system was said to work excellently and without jealousy. The tendency of the large firms pressed into substitution or dilution by the Ministry of Munitions has been to turn to the educated women to control women workers they were obliged to employ, and I have recently come across an instance of a woman's successful management of a factory engaged in the manufacture of pickles and sauces.

In several of the increasingly numerous books on welfare and scientific management of conditions of health and welfare it is amply recognised that supervision of this side of factory life must be an integral part of the general management, in order to secure both an adequate bedrock on which to build and progressive improvement. "There can be no second man in matters of human import. Either the general manager must be in effect the employment manager, or the large employment scheme will not work. Put the kind of employment manager required to administer this (welfare) scheme . . . under a general manager without a social point of view and one of two things must happen. Either the programme waits while the employment expert is saving the soul of the general manager and really fitting his superior to do the superior job, or the expert must quit, a failure" (7). Signs are not wanting, however, in our factories that the workers themselves are co-operating with both managers and experts in new ways that may happily solve the problems on democratic lines.

Organized Initiative of Employers and Workers

A great movement forward in general industrial welfare and health may be expected when both joint standing industrial

councils (national and district) and works' committees thoroughly representative of workers and employers, with due provision for representation of women workers come into full activity, aided on the technical side of factory welfare by an expert factory inspectorate and access to a well-developed industrial museum. It is impossible in this report to do more than indicate, by such instances as those given in the foregoing paragraphs on observance of orders, the extensive work that is already in preparation, with active co-operation and guidance from the factory inspectors.

Some examples may, however, be referred to of more direct voluntary initiative of organised employers and workers. In October, 1918, Mr. A. C. Yates, ex-President of the Leicester Chamber of Commerce, himself connected with a firm of worsted spinners, issued a *Report on Industrial Welfare Work* in that town based on a formal enquiry he had sent out a few months earlier with the consent of the Chamber of Commerce to 310 firms in the town, covering a wide range of subjects. In the report he defined welfare work as including all endeavours made by employers, with the assistance of their employees, to improve the conditions of workers beyond the actual requirements of the Factory Acts, including wages and hours of employment, housing, profit-sharing, rest rooms, messrooms and canteens, first aid appliances, additional lavatories, cloakrooms, baths and gymnasia, indoor and outdoor games, evening entertainments and lectures, welfare secretaries. Some of these and a few other points Mr. Yates included in his *questionnaire* to firms, the result of which is summarised as follows by Mr. Harston, Deputy Superintending Inspector for the Midland Division:

> Only 110 forms were returned. This disappointing result, Mr. Yates thought, was probably due to a natural objection felt by many to filling up forms with so many replies in the negative, and also that they were all getting tired of filling up forms. He had purposely left wages and hours and the provision of houses out of consideration. The health of the workers was so bound up with industrial welfare that the subjects could not be definitely separated except in certain trades where special sanitary precautions had been taken. The true welfare of a person was marred not only by physical weakness but also by discontent, monotony, and lack of interest in life.
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> The replies he received showed that 39 firms had cloakrooms and lavatories in addition to the Factory Act requirements, 42 had messrooms, and 5 had accommodation for cooking food, while 6 had fully equipped canteens, 14 had rest rooms, 70 provided first aid appliances, 7 supplied a medical or dental service, 46 had benefit or sick clubs, 4 had pension schemes, supplementing the government scheme, 22 had adopted compulsory uniforms in certain departments, 1 had a gymnasium. A fourth of the replies stated that some entertainments of the workpeople were being organised, 11 had holiday schemes. Half of the firms were offering inducements to attend continuation and technical schools. One had educational lectures. Nine had welfare supervision. One-fourth of the firms had some scheme for the visitation of absentees or sick employees, and a similar number had representative works' committees; 42 firms encouraged, by rewards, suggestions from workpeople with regard to economics, 6 had co-partnership or profit-sharing schemes, and 21 had spare land cultivated by employees.
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> The question "Have you any other kind of welfare work?" produced very few replies, but two were specially interesting. One firm had an institute providing billiards, skittles, cards, refreshments, etc., and the other had purchased a farm of 150 acres with a farmhouse, and a large house suitable for a convalescent home.
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> The *questionnaire* had been prepared in the hope that many would feel prompted to make new endeavours to add to the welfare of those who were in their employment.

In March, 1918, a conference, convened by the British Association for Industrial Reconstruction, between organisers of trade unions, Bristol employers and others concerned with the industrial employment of women, was held at Shipham, Somerset. Their strong support was given to the policy of the Whitley Reports of constituting a new control in industry by

establishing in each industry a system of self-government through joint standing industrial councils equally representative of organised employers and operatives engaged in it, and the great potential value of works' committees for the satisfactory conduct of industry in detail was specially stressed. The belief was further strongly maintained that there is a "great field of usefulness open to welfare work, conducted by suitable and properly trained persons," with a view to humanising industrial life. The function, they said, of a welfare supervisor, is "to see that proper attention is paid to the human as contrasted with the productive aspects of factory life and work," and the description could hardly be bettered for practical guidance.

The conference at Shipham, including trade union leaders and employers, gave decisive support to the movement for a new humanising of factory conditions by methodical administrative means. After animated debate not free from warm arguments, even "supervision" of welfare, of the right kind, was admitted as indispensable. Equally decided was the memorandum on *Welfare Supervision* (April, 1918), published by the Woolwich District Trade and Labour Council, assuming as it did that the supervision was primarily for the workers' welfare and not really aimed at increasing their output, and that no supervisor should be appointed without preliminary training and experience to include knowledge of trade union aims and methods. This memorandum indeed called for a co-ordinated extension of welfare schemes among small factories with development of efficient co-operation in matters of health, housing, transit and recreation with the municipal authorities. . . .

The new educational experiments of employers, found in an increasing number of factories, seem likely to both strengthen and enlighten the development of self-government in industry. These experiments vary in a wide and instructive degree. Some are directly associated with the organisation of welfare in the sense of the Act of 1916, others are an avowed effort to act as forerunners of the requirements of the Education Act of 1918 by carrying on the education of girls and boys from the school leaving age, when they enter the factory, either to 16 or (in some cases) to 18 years of age, both in works' schools and by payment of fees for continuation classes outside the factory. Even where, as in other cases, they frankly tend rather especially to fit the workers to become good and efficient factory workers than to supply them with more general education, instances are not lacking of original and promising experiment. It has been found where serious continuation teaching has been given for two years to girls from 14 years onwards in well organised works' schools, under direction of a county council organiser, that education of forewomen is also necessary in support of control and authority in the work of the factory. To these forewomen teaching is now given in industrial history as well as English, arithmetic, physical exercises and home nursing, with the aim of enabling them to keep hold of the proper influence with the young workers under their charge,. who are advancing rapidly in physique, *morale* and intelligence under liberal teaching provided for them in the works' school. . . .

BIBLIOGRAPHY

1. For development of this idea see Ioteyko, J.: The Science of Labour and Its Organization. London, George Routledge & Sons, Ltd., 1919; New York, E. P. Dutton & Company, 1919.
2. Watkins, G. P.: Welfare as an Economic Quantity. Boston and New York, Houghton Mifflin Company, 1915.
3. Smart, W.: Economic Annals of the Nineteenth Century, 1910, p. vii.
4. Messrooms and Canteens at Small Factories and Workshops. London, H. M. Stationery Office, 1918.
5. Protective Clothing for Women and Girl Workers. London, H. M. Stationery Office, 1917.
6. Obtainable from H. M. Stationery Office, Underwood Street, Shepherdess Walk, City Road, London, N., or from H. M. Chief Inspector of Factories, Home Office, London, S. W. 1, or from the Employment Department, Ministry of Labour, Queen Anne's Chambers, London, S. W. 1.
7. Fisher, B.: Industrial Loyalty. London, George Routledge & Sons, Ltd., 1918, p. 15.

BOOK REVIEWS

Injuries to the Head and Neck. By H. Lawson Whale, M.D. Camb., F.R.C.S. Eng., Capt. R.A.M.C. (T.F.), formerly Capt. I.M.S. (retired); The Queen's Hospital, Sidcup; No. 83 General Hospital; and Surgical Specialist to No. 53 General Hospital, B.E.F.; Surgeon for the Ear, Throat, and Nose to the London Temperance Hospital, and to the Hampstead General Hospital. With preface by Col. Frederick F. Burghard, C.B., M.D., M.S., F.R.C.S. Cloth. Pp. 322 with illustrations and index. New York: Paul B. Hoeber, 1919.

This is distinctly a book for reference in industrial surgery. Entirely a treatise on war surgery of the head and neck, it deals with the difficult problems arising from shell and gun shot wounds of these parts. Naturally, similar problems arise seldom in industrial work and only occur when a piece of flying steel strikes the head or neck — an uncommon accident.

The chapters on rhinoplasty are of interest and of considerable value to the industrial surgeon inasmuch as injury to the nose of an extensive character is occasionally met with, and the technique here outlined is very valuable as a guide. There is an excellent section on after-treatment and dressings of these difficult cases.

In the chapters on the treatment of jaw injuries, the treatment of jaw fragments is particularly valuable, while the difficult problem of anesthesia is well discussed.

The general plan of the author is to discuss the injuries and their treatment generally, and then to give specific instances of cases under his personal observation. For surgeons desiring a well written, clearly illustrated book of convenient size devoted to severe injuries of the head and neck, Doctor Whale's book will prove a valuable work. — *W. Irving Clark, Jr.*

Textbook of Meat Hygiene. With Special Consideration of Antemortem and Postmortem Inspection of Food-Producing Animals. By Richard Edelmann, Ph.D., Medical Counsellor; Royal State Veterinarian of Saxony; Professor at the Royal Veterinary High School in Dresden. Fourth revised edition by John R. Mohler, A.M., V.M.D., Chief, U. S. Bureau of Animal Industry, and Adolph Eichhorn, D.V.S., Director, Veterinary Department, Lederle Antitoxin Laboratories; Formerly Chief, Pathological Division, U. S. Bureau of Animal Industry. Cloth. Pp. 472 with index and illustrations. Philadelphia: Lea & Febiger, 1919.

An exceedingly important item in the dietary of the people of this country is meat, and its sanitary production and handling should be thoroughly safeguarded in every possible way. It was stated by Dr. Mohler last year that one-third of the meat consumed in this country did not undergo federal inspection. Yet the need for complete and efficient meat inspection is great when we consider the enormous quantities of meats that have to be condemned on account of disease or unsoundness.

The scope of meat hygiene is a broad one and is founded on strict scientific principles which this newly revised edition of Edelmann's textbook endeavors to present in the light of American conditions and experience. The various phases in the production, preparation, and conservation of meat are taken up from a practical standpoint, and the regulations of the United States Department of Agriculture governing meat inspection are given in detail, together with the organization and methods of procedure of the inspection force. Following this exposition of the administrative side of meat hygiene there are discussed the abnormal conditions and diseases of food-producing animals, the postmortem changes of meat and the examination of prepared and preserved meats. Most of the essential information on meat poisonings is presented, as well as a history of meat hygiene, followed by chapters on abattoirs and stockyards and the preparation and control of meat-food products. A brief summary of some of the more important and useful chemical analyses in meat inspection is appended. — *Barnett Cohen.*

BOOKS RECEIVED

Books received are acknowledged in this column, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Negro Migration During the War. By Emmett J. Scott, Secretary-Treasurer, Howard University, Washington, D. C. Carnegie Endowment for International Peace. Preliminary Economic Studies of the War, No. 16. Edited by David Kinley, Professor of Political Economy, University of Illinois, and Member of Committee of Research of the Endowment. Paper. Pp. 189 with bibliography and index. New York: Oxford University Press, 1920.

A Manual of Physical Diagnosis. By Austin Flint, M.D., LL.D., Late Professor of the Principles and Practice of Medicine and of Clinical Medicine in Bellevue Hospital Medical College, etc. Eighth Edition revised by Henry C. Thacher, M.S., M.D., Assistant Professor of Clinical Medicine in the College of Physicians and Surgeons of Columbia University, Assistant Attending Physician, Roosevelt and Lincoln Hospitals, New York. Cloth. Pp. 362 with illustrations and index. Philadelphia: Lea & Febiger, 1920.

Sanity in Sex. By William J. Fielding. Cloth. Pp. 333 with index and bibliography. New York: Dodd, Mead and Company, 1920.

Early Effects of the War upon the Finance, Commerce and Industry of Peru. By L. S. Rowe, Ph.D., LL.D., Professor of Political Science, University of Pennsylvania. Carnegie Endowment for International Peace. Preliminary Economic Studies of the War, No. 17. Edited by David Kinley, Professor of Political Economy, University of Illinois; Member of Committee of Research of the Endowment. Paper. Pp. 60. New York: Oxford University Press, 1920.

INSTITUTE OF INDUSTRIAL NURSING

An Institute of Industrial Nursing under the auspices of the New Haven Visiting Nurse Association will be held September 20 to 30, inclusive, at 35 Elm Street, New Haven, Conn.

An intensive and interesting program has been prepared and the following experts in Public Health will give lectures:

C.-E. A. Winslow — Industrial Hygiene.
Florence Swift Wright — Industrial Nursing.
C. C. Burlingame — Hospital Management and Record Keeping.
George Blumer — Industrial Diseases.
R. M. Thompson — Industrial Relations.
Mary P. Wheeler — Social Problems.
H. C. Link — Industrial Psychology.
Maria Nelson — Nutrition and Budgets.

Only graduate registered nurses interested in industrial work are eligible — preferably nurses with public health experience.

The fee is $5.00, payable at time of registration, which must be not later than September 12.